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RADIOLOGICAL HEALTH DATA

MONTHLY REPORT

March 1961

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service

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Public Health Service

Division of Radiological Health

PREFACE

In August 1959, the President directed the Secretary of Health, Education, and Welfare to intensify Departmental activities in the field of radiological health. The Department was assigned responsibility within the Executive Branch for the collation, analysis and interpretation of data on environmental radiation levels. The Department delegated this responsibility to the Division of Radiological Health, Public Health Service.

Radiological Health Data is published by the Public Health Service on a monthly basis. Data are provided to the Division of Radiological Health by other Federal agencies, State health departments, and by foreign governments. Except where material is directly quoted, summaries are prepared by the staff of the Division of Radiological Health. The reports are reviewed by a Board of Editorial Advisors with representatives from the following Federal agencies:

Department of Health, Education, and Welfare
Atomic Energy Commission
Department of Defense
Department of Commerce
Department of Agriculture

TABLE OF CONTENTS

	Page
PREFACE	iii
SECTION I.--AIR	
Public Health Service Radiation Surveillance Network	113
Radioactivity of Particulates in Air (October 1960)	114
Radon and Thoron Measurements (October 1960)	115
Radioactivity Measurements in Air--U.S. Naval Research Laboratory	116
Daily Record of Fission Product Beta Activity Collected by Air Filtration (October 1960)	116
Profile of Beta Activity	118
SECTION II.--FOOD, OTHER THAN MILK	
High Consumption of Foods--U. S. Department of Agriculture	119
SECTION III.--MILK	
Public Health Service Milk Monitoring Program	123
Radioactivity in Milk (October 1960)	125
Radioactivity in Milk (July-August 1960)--Health and Safety Laboratory, Atomic Energy Commission	127
SECTION IV.--WATER	
Public Health Service National Water Quality Network	129
Radioactivity in Raw Surface Waters (September 1960)	131
SECTION V.--OTHER DATA	
External Gamma Activity (October 1960)--Public Health Service Radiation Surveillance Network	134
Soil Data--Argonne National Laboratory	135
Environmental Levels of Radioactivity at Atomic Energy Commission Installations	135
Mound Laboratory	135
Oak Ridge National Laboratory	140
Paducah Gaseous Diffusion Plant	147
Portsmouth Gaseous Diffusion Plant	150
Factors Contributing to the Occurrence of Radionuclide Levels Market Milk--Public Health Service	154
Michigan Survey of Medical Radiation Exposure During Pregancy--Public Health Service	159
Natural Lead-210 Content of Man--University of Rochester	164
Radiation Intelligence Network--Public Health Service	165
Radiation Survey Report--Illinois Department of Public Health	165

SECTION I.—AIR

PUBLIC HEALTH SERVICE RADIATION SURVEILLANCE NETWORK

The Public Health Service Radiation Surveillance Network was established in 1956 in cooperation with the Atomic Energy Commission to provide a means of promptly determining increases in environmental radiation due to radioactive fallout from nuclear weapons tests. Although no nuclear tests have been conducted by the United States since 1958, the program has proved sufficiently valuable that it has been extended to a round-the-year basis and currently consists of 45 stations at urban locations (see figure 1) operated by State and local health department personnel with 2 stations operated by U. S. Public Health Service personnel.

Measurements of gross beta radioactivity in air have been taken since they provide one of the earliest and most sensitive indications of increases of activity in the environment, and thus act as an "alert" system. A direct evaluation of biological hazards is not possible from these data alone. However, field measurements do enable the operator to estimate the amount of beta activity of particulates in the air at the station five hours after collection by comparison with a known source, using a portable survey meter. The filters are then forwarded to a laboratory in Washington, D. C. for a more refined measurement using a thin window proportional counter.

Air samplers are in operation at the 45 stations on an average of 70 percent of the week. Air is drawn through a cellulose carbon loaded dust filter using a high volume air sampler. The radioactive material in fallout adhering to small dust-like particles is retained on the filter. Some gaseous fission products are adsorbed by the carbon. The contribution by gaseous fission products has represented only a small part of the total beta activity in these samples.

About 85 percent of the stations collect samples of precipitation which are sent to Washington, D. C. for analysis. Values are now below limits of detection by present instrumentation. New equipment is being procured to measure lower values. Measurements have indicated that the bulk of deposited activity occurs through precipitation, but concentrations in surface air are not directly related to the amount deposited through precipitation.

Tables 1 and 2 summarize the data for October 1960.

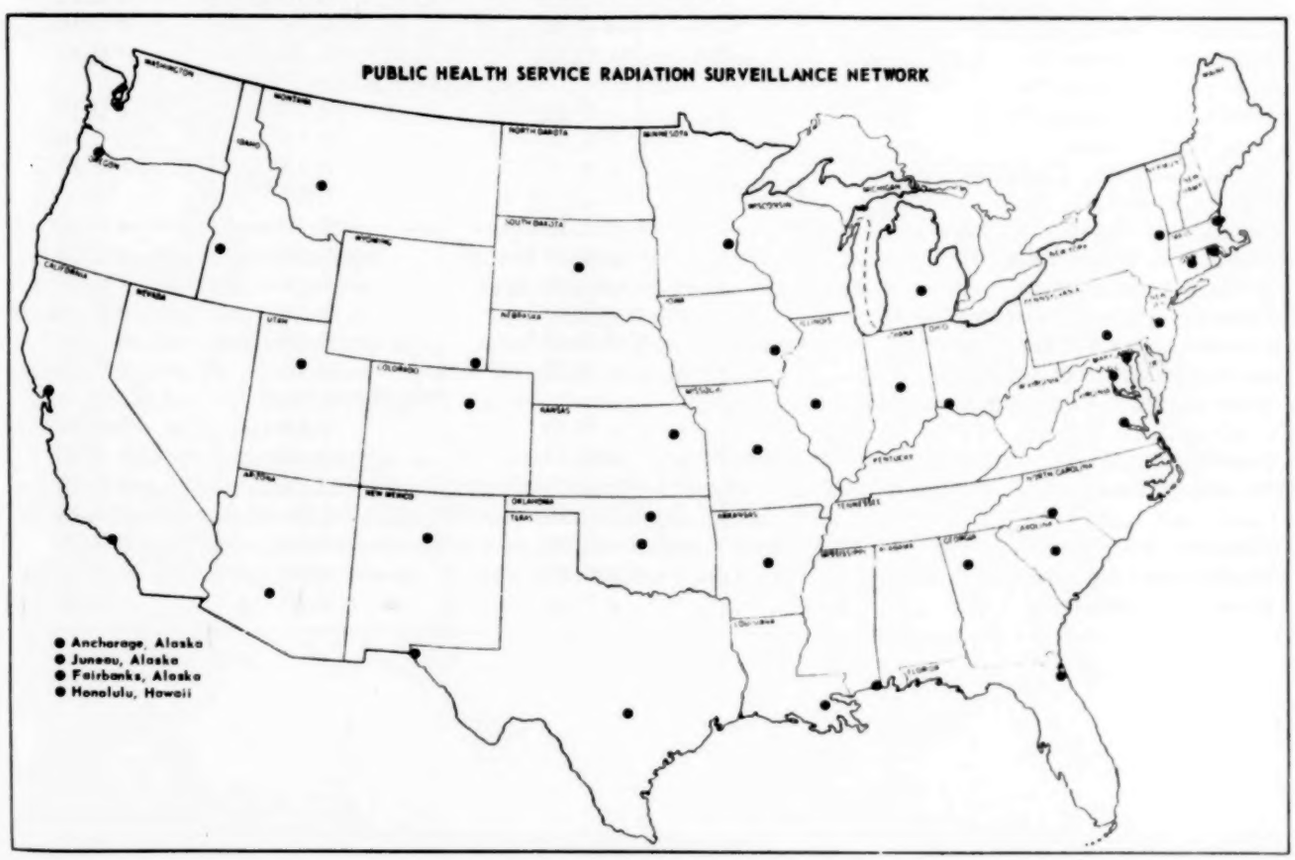


FIGURE 1

TABLE 1.--RADIOACTIVITY OF PARTICULATES IN AIR-GROSS BETA DETERMINATION

Public Health Service Radiation Surveillance Network

October 1960

Station Location	Weighted average ($\mu\mu c/m^3$)	Maximum ($\mu\mu c/m^3$)	Minimum ($\mu\mu c/m^3$)
Alaska, Anchorage	< 0.10	< 0.10	< 0.10
Alaska, Fairbanks	< 0.10	0.12	< 0.10
Alaska, Juneau	< 0.10	< 0.10	< 0.10
Arizona, Phoenix	< 0.10	0.12	< 0.10
Arkansas, Little Rock	< 0.10	0.12	< 0.10
California, Berkeley	< 0.10	< 0.10	< 0.10
California, Los Angeles	< 0.10	0.11	< 0.10
Colorado, Denver	< 0.10	< 0.10	< 0.10
Connecticut, Hartford	< 0.10	0.13	< 0.10
District of Columbia	< 0.11	< 0.20	< 0.10
Florida, Jacksonville	< 0.10	< 0.10	< 0.10
Georgia, Atlanta	< 0.10	0.12	< 0.10
Hawaii, Honolulu	< 0.10	< 0.10	< 0.10
Idaho, Boise	< 0.10	< 0.10	< 0.10
Illinois, Springfield	< 0.11	0.17	< 0.10
Indiana, Indianapolis	< 0.10	0.13	< 0.10
Iowa, Iowa City	< 0.10	0.12	< 0.10
Kansas, Topeka	< 0.10	< 0.10	< 0.10
Louisiana, New Orleans	< 0.10	< 0.10	< 0.10
Maryland, Baltimore	< 0.10	0.10	< 0.10
Massachusetts, Lawrence	< 0.10	< 0.10	< 0.10
Michigan, Lansing	< 0.10	0.16	< 0.10
Minnesota, Minneapolis	< 0.10	< 0.10	< 0.10
Mississippi, Pascagoula	< 0.13	0.18	< 0.10
Missouri, Jefferson City	< 0.10	< 0.10	< 0.10
Montana, Helena	< 0.10	< 0.10	< 0.10
New Jersey, Trenton	NO SAMPLES RECEIVED		
New Mexico, Santa Fe	< 0.12	0.19	< 0.10
New York, Albany	< 0.10	0.13	< 0.10
North Carolina, Gastonia	< 0.11	0.18	< 0.10
Ohio, Cincinnati	0.1	0.2	0.0
Oklahoma, Oklahoma City	< 0.10	< 0.10	< 0.10
Oklahoma, Ponca City	< 0.10	< 0.10	< 0.10
Oregon, Portland	< 0.10	0.14	< 0.10
Pennsylvania, Harrisburg	< 0.10	0.16	< 0.10
Rhode Island, Providence	< 0.10	< 0.10	< 0.10
South Carolina, Columbia	< 0.10	< 0.10	< 0.10
South Dakota, Edgemont	INACTIVATED		
South Dakota, Pierre	< 0.10	0.12	< 0.10
Texas, Austin	< 0.10	< 0.10	< 0.10
Texas, El Paso	< 0.13	0.22	< 0.10
Utah, Salt Lake City	< 0.19	2.06	< 0.10
Virginia, Richmond	< 0.10	0.11	< 0.10
Washington, Seattle	< 0.10	< 0.10	< 0.10
Wyoming, Cheyenne	< 0.10	< 0.10	< 0.10

TABLE 2.--RADON AND THORON MEASUREMENTS

Public Health Service Radiation Surveillance Network
Station at Cincinnati, Ohio

October 1960

Date	Continuous sample collection			Radon[a] a.m. (μμc/m³)	Radon[b] p.m. (μμc/m³)	Thoron[c] (μμc/m³)	Beta[d] activity (μμc/m³)
	Sample change time	Sampling period (hours)	Volume (m³)				
3	0812	71.8	87.5	670	260	8.3	0.1
4	0835	24.3	27.5	780	210	9.6	0.1
5	0800	23.4	26.9	1300	270	3.9	0.2
6	0820	24.3	29.5	220	330	3.2	0.1
7	0805	23.8	28.9	450	190	4.0	0.1
10	0825	72.3	85.0	940	220	6.9	0.1
11	0816	23.8	28.5	790	250	7.7	0.2
12	0815	24.0	29.3	1000	290	9.1	0.2
13	0810	23.9	29.1	1200	260	9.9	0.1
14	0810	24.0	29.1	1500	260	10.7	0.2
17	0810	72.0	82.1	610	150	8.0	0.1
18	0818	24.0	29.5	920	430	8.5	0.1
19	0815	23.9	29.1	740	640	8.5	0.2
20	0816	24.0	29.1	160	90	2.4	0.1
21	0820	24.0	29.4	930	130	4.6	0.2
24	0943	73.3	90.2	160	90	2.9	0.1
25	0825	22.7	28.2	980	150	6.8	0.1
26	0825	24.0	29.4	470	310	7.1	0.1
27	0820	23.9	29.4	410	520	3.5	0.0
28	0820	24.0	29.2	570	310	3.5	0.1
31	0805	71.7	86.5	220	160	3.4	0.1
Average.....				650	240	6.0	0.12

(a) Radon concentrations are derived from alpha measurements determined immediately after the sampling period (24-96 hours) has ceased. Reported radon concentrations have been corrected for any thoron daughter interferences. Twice the standard deviation (2 σ) falls between ± 20 and ± 70 μμc/m³.

(b) Radon concentrations are derived from alpha measurements made in the afternoon approximately 7 hours (3 p.m.) after the raw sampling period has begun. Reported radon concentrations are uncorrected for any thoron daughter interferences. Twice the standard deviation (2 σ) falls between ± 16.0 and ± 45.0 μμc/m³.

(c) Thoron concentrations are derived from alpha measurements made from the same filters used in footnote a, above, but are counted approximately 7 hours after the sampling period has ceased. Twice the standard deviation (2 σ) falls between ± 0.30 and 0.70 μμc/m³.

(d) Gross beta concentrations are based on measurements made at least 4 days after each sampling period (24-96 hours) has ceased. Twice the standard deviation (2 σ) falls between ± 0.01 and ± 0.03 μμc/m³.

RADIOACTIVITY MEASUREMENTS IN AIR

U. S. Naval Research Laboratory

Radioactivity measurements of air-filter samples collected at various sites along the 80th Meridian (West) are made by the U. S. Naval Research Laboratory under a program partially financed by the Atomic Energy Commission.

The daily record of fission product beta activity during October 1960 is shown in table 1, while the radioactivity profile for the same month is shown in figure 1. All radioactivity concentrations are given in disintegrations per minute per cubic meter of air at the collecting site (2.2 disintegrations per minute per cubic meter equals 1 micromicrocurie per cubic meter).

TABLE 1.--DAILY RECORD OF FISSION PRODUCT BETA ACTIVITY COLLECTED BY AIR FILTRATION

U. S. Naval Research Laboratory

October 1960

(dpm/m^3)

Day	Punta Arenas, Chile	Puerto Montt, Chile	Santiago, Chile	Antofagasta, Chile	Chacaltaya, Bolivia	Lima, Peru	Guayaquil, Ecuador
1	-	0.03	0.09	0.11	0.02	0.06	0.02
2	-	0.03	0.09	0.11	0.02	0.06	0.02
3	-	0.03	0.09	0.11	0.02	0.06	0.02
4	-	0.06	0.07	0.08	0.03	0.04	0.02
5	-	0.06	0.07	0.08	0.03	0.04	0.02
6	-	0.04	0.04	0.17	0.05	0.04	0.02
7	-	0.04	0.04	0.17	0.05	0.04	0.02
8	-	0.04	0.07	0.13	-	0.10	0.04
9	-	0.04	0.07	0.13	0.03	0.10	0.04
10	-	0.04	0.07	0.12	0.03	0.10	0.05
11	-	0.01	0.08	0.12	0.03	0.09	0.05
12	-	0.01	0.08	0.12	0.05	0.09	0.06
13	-	0.04	0.11	0.14	0.06	0.11	0.04
14	-	0.04	0.11	0.14	0.08	0.11	0.03
15	-	0.04	-	0.17	0.11	0.05	0.03
16	-	0.04	0.11	0.17	0.12	0.05	0.03
17	-	0.04	0.11	0.17	0.12	0.05	0.04
18	-	0.04	0.09	-	0.08	0.11	0.02
19	-	0.04	0.09	-	0.08	0.11	0.02
20	-	0.04	0.09	-	0.05	0.03	0.02
21	-	0.04	0.09	-	0.05	0.03	0.02
22	-	0.03	0.06	-	0.05	0.04	0.02
23	-	0.03	0.06	-	0.05	0.04	0.02
24	-	0.03	0.06	-	0.09	0.04	0.02
25	-	0.03	0.09	-	0.08	0.05	0.05
26	-	0.03	0.09	-	0.11	0.05	0.06
27	-	0.08	0.14	-	0.08	0.05	0.03
28	-	0.08	0.14	-	0.05	0.05	0.03
29	-	0.08	0.14	-	0.06	0.06	0.03
30	-	0.08	0.14	-	0.06	0.06	0.03
31	-	0.08	0.14	-	0.12	0.06	0.05
Mean value	-	0.04	0.09	0.13	0.06	0.06	0.03

TABLE 1.--DAILY RECORD OF FISSION PRODUCT BETA ACTIVITY COLLECTED BY AIR FILTRATION--Con.

U. S. Naval Research Laboratory

October 1960

(dpm/m^3)

Day	Miraflores, Panama Canal	Mauna Loa, Hawaii	Miami, Florida	Washington, D. C.	Moosonee, Ontario, Canada	Thule, Greenland	Bravo, Arctic Ice Floe
1	0.04	0.06	0.06	0.12	0.07	0.03	0.02
2	0.04	0.06	0.06	0.12	0.07	0.03	0.02
3	0.04	0.06	0.06	0.12	0.07	0.03	0.02
4	0.03	0.11	0.10	0.10	0.09	0.04	0.04
5	0.03	0.11	0.10	0.10	0.09	0.04	0.04
6	0.03	0.11	0.07	0.16	0.08	0.08	0.04
7	0.03	0.11	0.07	0.16	0.08	0.08	0.04
8	0.03	0.15	0.04	0.11	0.03	0.05	0.04
9	0.03	0.15	0.04	0.11	0.03	0.05	0.04
10	0.03	0.15	0.04	0.11	0.03	0.05	0.05
11	0.02	0.06	0.04	0.20	-	0.06	0.05
12	0.02	0.06	0.04	0.20	-	0.06	0.05
13	0.03	0.07	0.04	0.32	0.08	0.05	0.05
14	0.03	0.07	0.04	0.32	0.08	0.05	0.05
15	0.02	0.07	0.05	0.21	0.10	0.07	0.05
16	0.02	0.07	0.05	0.21	0.10	0.07	0.05
17	0.02	0.07	0.05	0.21	0.10	0.07	0.05
18	0.03	0.02	0.11	0.29	0.03	0.04	0.05
19	0.03	0.02	0.11	0.29	0.03	0.04	0.05
20	0.02	0.02	0.08	0.16	0.10	0.10	0.05
21	0.02	0.02	0.08	0.16	0.10	0.10	0.05
22	0.02	0.03	0.14	0.15	0.10	0.04	0.05
23	0.02	0.03	0.14	0.15	0.10	0.04	0.05
24	0.02	0.03	0.14	0.15	0.10	0.04	0.07
25	0.02	0.08	0.17	0.13	0.10	0.02	0.07
26	0.02	0.08	0.17	0.13	0.10	0.02	0.07
27	0.02	0.04	0.08	0.16	0.20	0.07	0.07
28	0.02	0.04	0.08	0.16	0.20	0.07	0.07
29	0.02	0.09	0.17	0.16	0.12	0.03	0.07
30	0.02	0.09	0.17	0.16	0.12	0.03	0.07
31	0.02	0.09	0.17	0.16	0.12	0.03	0.07
Mean value	0.03	0.07	0.09	0.17	0.09	0.05	0.05

PROFILE OF BETA ACTIVITY

AVERAGE MEASUREMENTS OF SURFACE AIR
AT STATIONS ALONG THE 80TH MERIDIAN (WEST)

U. S. Naval Research Laboratory

October 1960

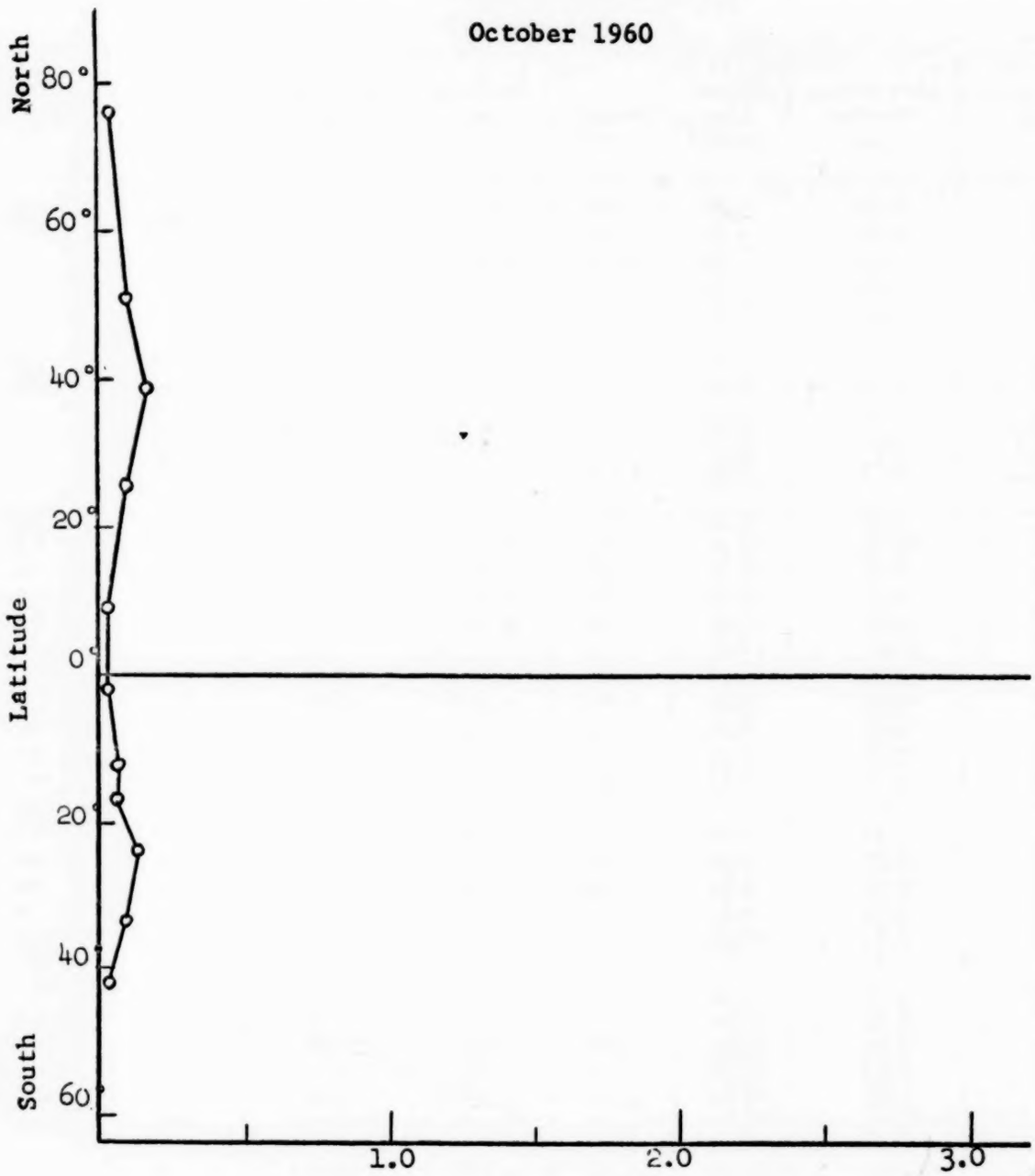


FIGURE 1. AVERAGE FISSION PRODUCT BETA ACTIVITY
(dpm/m^3)

SECTION II.—FOOD, OTHER THAN MILK

HIGH CONSUMPTION OF FOODS

United States Department of Agriculture
Agricultural Research Service
Household Economics Research Division

Because of an increasing need for estimating chemical residues, food additives and radioactivity in foods, there has been growing interest in information on quantities of foods used by high consumers as well as average consumers. Tables showing average quantities of some 200 foods used per person per household were prepared by the United States Department of Agriculture based on its 1955 Household Food Consumption Survey. These were published in Radiological Health Data, Volume I, Numbers 5, 6 and 7.

The 1955 survey (latest nationwide) has also been used to estimate quantities of some 60 foods used by high consumers. Although the survey does not provide information on consumption by individuals (only on quantities used by the household group), statistical measures have been computed that are a useful, though not exact, measure of what high consumers of each designated product consumed in one week during the spring of 1955. Any calculation of quantities of foods used by high consumers obviously involves a decision as to what is "high." The ninth decile has been adopted since it is reasonably simple to compute and is not likely to be influenced by a few unusually high reports as might be the case with the "the highest one" or the "mean of the highest 10 percent." A "ninth decile" is a value that divides the highest 10 percent of consumers from the other 90 percent. They were computed from special tabulations: listings, in order of magnitude, of a week's consumption per person in each household. Before the listings could be made, the quantity reported to have been used at home during the previous 7 days by each housekeeping household was divided by the size of that household (in 21 meal-at-home equivalent persons).

Amounts of foods used by high consumers as reported here are not additive. Persons eating large quantities of one item do not necessarily eat large quantities of other items. No household or individual within a household could possibly consume all of the foods in the amounts listed as high consumption.

Because it may be useful to compare the consumption means and these newly derived estimates of quantities consumed by high consumers, the tables present the two statistics for each region. The estimated ninth decile is from 1 1/2 to 3 1/2 times the mean for broad groups of foods. In general the ratios for the items within the groups are even higher than the ratios for the groups, for the more finely specified the food (i.e., an item rather than a group) the greater the family-to-family variability and, therefore, the greater the magnitude of the measure of the variability used (such as the ratio here).

Limitations of data

As estimates of high consumption by individuals, these ninth decile values tend to be low. This is because the data for high-consuming individuals have been combined with that of other members of the same household to obtain per-person averages.

Another limitation of the method results from the fact that the basic data are for a week. Considerable week-to-week variability in household food consumption is believed to exist. This tends to make the ninth decile a poorer estimate of sustained medium high consumption than of short-term, very high consumption.

In addition to the problems of definition inherent in using the "average consumption per person" for each household, the method of computing the ninth decile value from the arrays also tends to underestimage this "high consumption value." Theoretically, the ninth decile should be computed from an array or distribution of the values for all households arranged in order of magnitude. These consumption values, however, were arrayed within income class and within urbanization group for each region. An approximation of the ninth decile was made by computing first the ninth decile for each of the subclasses, and then the weighted mean of these ninth deciles. The approximations were compared with the exactly computed ninth deciles for a sample of the results. Almost without exception, the approximations were quite close but somewhat low.

The comparison of the ninth decile with the mean is not technically appropriate on two grounds: (a) the ninth decile is the value at a point in the array, so it should be compared with the medium rather than the mean, and (b) the deciles and means were computed with basically different weights. In the former, equal weight was given to each household; in the latter, equal weight to each person. Per person consumption tends to be less in larger households, hence the mean is smaller than if equal weight were given to each household. Since these two factors have counteracting effects their net result on the ratios of high to average consumption is probably not great.

Table 1 shows high consumption defined as the ninth decile and average consumption as the mean value.

TABLE 1.—HIGH AND AVERAGE FOOD CONSUMPTION PER PERSON PER WEEK IN HOUSEHOLDS BY REGION, SPRING 1955

(Pounds)

Food	Northeast		North Central		West		South	
	High[1]	Average[2]	High[1]	Average[2]	High[1]	Average[2]	High[1]	Average[2]
Milk, cream, ice cream, cheese (fluid milk equivalent[3])	15.59	9.72	15.81	10.24	16.73	10.42	16.25	8.56
Fresh fluid milk, total	12.35	7.37	13.22	8.05	13.29	7.54	13.39	6.00
Whole	12.00	7.00	12.60	7.52	12.27	6.80	11.44	4.94
Processed milk	1.98	.25	1.70	.19	2.93	.41	3.63	.51
Cream	.36	.10	.40	.12	.32	.10	.10	.03
Ice cream, ice milk	.83	.34	1.17	.47	1.07	.41	.91	.29
Cheese	.77	.33	.90	.38	.98	.43	.56	.21
Fats and oils, total	1.24	.76	1.51	.88	1.52	.92	1.73	1.01
Table fats, total	.69	.43	.79	.44	.79	.43	.66	.32
Butter	.58	.24	.60	.25	.50	.18	.41	.13
Margarine	.40	.19	.50	.19	.55	.25	.47	.19
Shortening	.34	.13	.54	.24	.45	.22	.94	.46
Salad and cooking oils	.23	.08	.12	.04	.27	.09	.12	.05
Salad dressings (commercial)	.31	.12	.37	.16	.41	.18	.39	.17
Flour and other cereal products, total	1.96	1.03	2.63	1.40	2.55	1.48	4.84	2.82
Flour other than mixes	.84	.32	1.46	.62	1.40	.66	2.63	1.42
Prepared flour mixes	.54	.17	.64	.22	.71	.26	.36	.13
Breakfast cereals (excluding baby cereals)	.51	.25	.56	.28	.58	.28	.48	.19
Other cereals	.69	.29	.60	.27	.64	.28	2.16	1.08
Bakery products total	3.70	2.22	3.77	2.25	3.72	2.14	3.20	1.59
Bread	2.58	1.53	2.79	1.62	2.79	1.55	2.29	1.09
Baked goods other than bread	1.54	.69	1.39	.63	1.41	.59	1.26	.50
Eggs	1.39	.78	1.57	.87	1.70	.96	1.65	.84
Meat, poultry, fish, total	7.38	4.33	7.42	4.37	7.58	4.34	6.98	3.70
Meat, total	5.46	3.07	5.70	3.38	5.93	3.37	4.80	2.58
Beef	2.66	1.29	2.98	1.51	3.46	1.62	2.04	.85
Veal	.43	.12	.40	.07	.28	.07	--	.04
Pork	2.29	.98	2.63	1.23	2.24	1.00	2.69	1.26
Lamb, mutton	.59	.19	--	.05	--	.13	--	.02
Variety meats and game	.31	.13	.34	.10	.52	.17	.34	.10
Luncheon meats	.78	.37	.91	.42	.83	.37	.73	.30
Poultry, total	2.16	.83	1.78	.65	1.83	.61	1.80	.70
Chicken[4]	1.99	.69	1.68	.59	1.72	.55	1.78	.67
Fish and shellfish	.99	.44	.72	.34	.87	.37	1.21	.42

See footnotes at end of table.

TABLE 1.--HIGH AND AVERAGE FOOD CONSUMPTION PER PERSON PER WEEK IN HOUSEHOLDS BY REGION, SPRING 1955--Con.

(Pounds)

Food	Northeast		North Central		West		South	
	High[1]	Average[2]	High[1]	Average[2]	High[1]	Average[2]	High[1]	Average[2]
Sugar, sweets, total	1.84	.99	2.30	1.28	2.22	1.20	3.34	1.45
Sugar	1.35	.67	1.65	.86	1.55	.75	1.83	.95
Sirups, molasses, honey	.23	.07	.27	.09	.33	.13	.55	.22
Jellies, jams	.33	.13	.46	.19	.43	.18	.53	.21
Candies (commercial)	.38	.12	.38	.13	.36	.13	.26	.08
Potatoes, sweetpotatoes, total	3.59	1.96	3.79	2.19	3.18	1.70	3.12	1.56
Fresh	3.48	1.90	3.72	2.09	3.11	1.62	3.08	1.53
Potato chips and sticks	.12	.03	.49	.06	.15	.04	.04	.02
Other	--	.02	--	.03	--	.04	--	.02
Fresh vegetables, total[5]	5.28	2.64	4.85	2.45	5.66	2.76	6.07	2.85
Dark green and deep yellow	1.25	.51	.91	.37	1.09	.43	1.16	.40
Other green	1.97	.94	2.21	.99	2.66	1.03	2.66	1.19
Tomatoes	.81	.34	.87	.32	.93	.35	1.06	.40
Other than tomatoes, and green and deep yellow	1.93	.85	1.75	.76	2.07	.94	2.11	.86
Fresh fruits, total[5]	6.32	2.93	6.72	3.26	6.84	3.18	5.47	2.33
Citrus	3.27	1.24	3.35	1.34	3.57	1.30	2.92	.91
Other than citrus	3.90	1.69	4.01	1.92	3.86	1.88	3.38	1.42
Commercially frozen fruits and vegetables, total	.67	.22	.55	.17	.76	.21	.37	.11
Fruits[6]	.13	.03	.11	.04	--	.03	--	.02
Vegetables other than potatoes	.63	.19	.41	.13	.02	.19	.31	.09
Commercially canned fruits and vegetables, total	2.62	1.23	2.91	1.39	3.11	1.48	2.56	1.00
Fruits, except baby and junior foods	1.22	.42	1.24	.48	1.52	.54	.98	.30
Vegetables, except baby and junior foods	1.64	.73	1.88	.85	2.08	.86	1.77	.64
Baby and junior foods	--	.08	--	.06	--	.08	--	.05
Fruit and vegetable juices, fresh, frozen, canned, powdered[7]	3.23	1.31	3.00	1.20	3.01	1.15	2.00	.67
Canned citrus[7]	1.05	.28	1.13	.32	.84	.27	.71	.24
Canned fruit other than citrus[7]	.99	.27	.48	.15	.70	.20	.29	.11
Canned tomato and other vegetable[7, 8]	.80	.20	.84	.23	.85	.21	.35	.11
Frozen concentrated	.50	.14	.51	.13	.40	.13	.12	.05
Fresh (commercial)	--	.05	--	.04	--	.01	--	.03
Dried fruits and vegetables, total[8]	.37	.11	.36	.12	.58	.21	.73	.30
Dried fruit	.21	.05	.20	.05	.28	.07	.14	.05
Dry vegetables	.14	.05	.21	.07	.33	.13	.61	.25
Beverages:								
Coffee	0.54	0.23	0.56	0.27	0.74	0.30	0.49	0.20
Tea[9]	.11	.03	.08	.02	.06	.02	.12	.03
Chocolate, cocoa, chocolate sirup	.08	.03	.08	.03	.06	.02	.06	.02
Soft drinks, fruit ades	2.76	.93	2.56	.96	2.19	.70	2.54	.90

See footnotes at end of table.

TABLE 1.--HIGH AND AVERAGE FOOD CONSUMPTION PER PERSON PER WEEK IN HOUSEHOLDS BY REGION, SPRING 1955--Con.

(Pounds)

Food	Northeast		North Central		West		South	
	High[1]	Average[2]	High[1]	Average[2]	High[1]	Average[2]	High[1]	Average[2]
Miscellaneous foods:								
Nuts (shelled weight) and peanut butter	.26	.09	.24	.09	.26	.10	.21	.07
Soups, except canned baby soups	.68	.24	.67	.25	.84	.34	.34	.11
Catsup, chili sauce, etc.	.32	.12	.31	.12	.37	.16	.19	.06
Pickles, olives, relishes[8]	.35	.12	.57	.20	.44	.15	.36	.12
Puddings, pie fillings, miscellaneous sweets (commercial)	.24	.09	.29	.10	.30	.11	.19	.06
Other mixtures, prepared or partially prepared	.70	.22	.55	.17	.77	.24	.45	.15
Leavening agents[9]	--	.02	.06	.03	.07	.03	.19	.05

[1] Ninth decile.

[2] Mean.

[3] Approximately the quantity of fluid milk to which the various dairy products (except butter) are equivalent in calcium. The products listed in the breakdown are shown as actual quantities.

[4] Chiefly fresh or frozen. Only small amounts of canned reported.

[5] Includes home canned and frozen items that were brought into the home in fresh form.

[6] Chiefly strawberries.

[7] Single strength equivalent; total includes the concentrated and dry items on the basis of single strength equivalent.

[8] Includes both commercially and home prepared products.

[9] Data refer to amounts bought during the 7-day period rather than the amounts used.

SECTION III.—MILK

PUBLIC HEALTH SERVICE MILK MONITORING PROGRAM

The original Public Health Service Milk Monitoring Program consisted of 12 sampling stations of which 9 are still active. Raw milk was spot sampled at these stations. During 1960 a new sampling program of about 60 stations was established. Processed milk was sampled at these stations. Since the sampling procedures for the raw milk sampling stations and the processed milk area sampling stations are different, they are described and reported separately. The Public Health Service Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio, continues to conduct the analyses for the original network stations; the Public Health Service Southeastern Radiological Health Laboratory at Montgomery, Alabama, and the Southwestern Radiological Health Laboratory at Las Vegas, Nevada, provide this service for the new program.

The purpose of the two sampling programs is not the same. The original network was established to develop sampling and radiochemical analytical proficiencies. During the existence of this program it became apparent that a broader sampling program, more directly related to the milk consumed by the population, was necessary, and the Public Health Service and the Department of Health, Education, and Welfare moved to provide facilities for this change. This resulted in the transition from the program of sampling raw milk, collected from milksheds of limited size, to a sampling program designed to be representative of the processed milk consumed in a given municipality.

In some instances the designated points are the same as those which were reported originally. The establishment of the new processed milk area sampling stations does not preclude the need for further raw milk sampling from the selected milkshed serving the same city. It is important that both networks be in operation for a sufficient period of time to provide an overlap for the purpose of comparative study.

Because of the different sources of these samples, changes in the collecting system, and the utilization of different laboratory techniques, differences were anticipated in the amounts of radioactivity found in the milk under the two programs. For this reason, an investigation to determine the comparability of the two programs was begun in January 1961. This investigation covers all possible factors including both the laboratory methodology and collecting methods. Until this study has been completed and additional experience has been gained under the new program, no valid interpretation can be made of any differences of radioactivity in milk samples collected under the two systems.

Publication of the data will normally follow about four months after collection of samples because of the time required for shipment, processing, decay product build-up, compilation of the data, clearance and publication procedures.

RAW MILK SAMPLING STATIONS

The initial purpose of establishing this network was in keeping with the normal and continuing program of the Public Health Service to determine trends in our changing environment, including measurement of amounts of radioactivity in water, air, milk and other foods. Milk was the food chosen for initial testing because it is among the most important components of the diet and is available at all seasons of the year and in all climates. A primary objective of the project was to develop effective collection systems and radiochemical analysis procedures to make them more suitable for larger scale programs.

The criteria on which the selection of the original sampling stations was based appeared in the discussion sections of all Volume I issues of Radiological Health Data.

One-gallon raw milk samples are collected once each month and forwarded by air parcel post to the Robert A. Taft Sanitary Engineering Center for radionuclide analysis. It is estimated that these samples represent 2,000-gallon lots. The concentrations of iodine-131, barium-140, cesium 137 and naturally-occurring potassium-40 are all currently being measured, when present in the milk, by gamma scintillation spectroscopy. Total radiostrontium and strontium-90 are determined following radiochemical separations, the strontium-90 being calculated by measuring the build-up in a two-week period of the daughter decay product, yttrium-90, using a low background anticoincidence beta counter. The total radioactive strontium is counted in a shielded internal proportional counter with the strontium-89 calculated as the difference.

April through September 1960 issues of Radiological Health Data list references for technical descriptions of the methodology of analyses used.

October data for the raw milk sampling stations are presented in table 1.

PROCESSED MILK AREA SAMPLING STATIONS

The monitoring of milk has been expanded to provide additional information on levels of radioactivity in milk consumed by the public. The new stations have been established in cooperation with State and local health and milk sanitation agencies. The cities have been selected in order to provide adequate coverage from the combined viewpoints of production areas and consuming population. The emphases on this expanded sampling and radioassay program are:

1. measuring the radioactivity levels of the milk consumed by the public in various regions of the country by obtaining samples of pasteurized and homogenized milk at the processing plant, and
2. providing one sampling point within each State with additional points when indicated by widely varying conditions of the milk supply or the need to provide coverage of large population groups. This differs from the original set of sampling stations whose selection was based principally upon certain criteria involving the milk production and milkshed area characteristics.

The new network was designed to sample processed milk rather than the raw product. The sampling procedure was developed to provide a sample from one day's sales per month in a community which will be as representative of the total supply as can be achieved under practical conditions. The sample will be a composite of those plants supplying not less than 90% of the city's milk supply. The contribution from each plant to the total sample will be approximately proportional to volume of milk sold.

The samples from the new stations are collected with the assistance of the various State and local health and milk sanitation agencies and are shipped for analysis to either the Southwestern or Southeastern Radiological Health Laboratory. The Southeastern Radiological Health Laboratory processes samples from the 30 states generally east of the Mississippi, and the Southwestern Radiological Health Laboratory processes samples from the western states.

At the present time radioassays for Sr^{89}, Sr^{90} and Cs^{137} are being performed. Other radionuclides of concern to public health agencies will be included for assay as necessary for complete monitoring of the milk supply.

Data from the two laboratories are presented in table 2.

TABLE 1.--RADIOACTIVITY IN MILK

Public Health Service Milk Monitoring Program
Robert A. Taft Sanitary Engineering Center

Raw Milk Sampling Stations

October 1960

(Radioactivity in μμc/liter)

Area	Calcium (grams/liter)		Iodine-131		Strontium-89		Strontium-90		Barium-140		Cesium-137	
	Oct.	Yearly average	Oct.	Yearly average	Oct.	Yearly average	Oct.	Yearly average	Oct.	Yearly average	Oct.	Yearly average
Atlanta, Ga.	1.11	1.12	ND	< 10	ND	< 5	12.6	15.1	ND	< 10	<5	40
Austin, Texas	1.23	1.10	ND	< 10	ND	< 5	3.9	4.6	ND	< 10	<5	20
Chicago, Illinois	1.16	1.09	ND	< 10	ND	< 5	8.9	9.5	ND	< 10	15	35
Cincinnati, Ohio	1.28	1.13	ND	< 10	ND	< 5	7.2	10.8	ND	< 10	10	25
New York, New York	1.14	1.08	ND	< 10	ND	< 5	7.0	9.5	ND	< 10	5	30
Sacramento, Calif.	1.20	1.11	ND	< 10	ND	< 5	2.4	3.8	ND	< 10	5	10
Salt Lake City, Utah (Sampling date, Nov. 9, 1960)	1.22	1.10	ND	< 10	ND	< 5	4.1	6.2	ND	< 10	20	30
Spokane, Washington	1.12	1.11	ND	< 10	ND	< 5	7.5	12.2	ND	< 10	15	45
St. Louis, Missouri	1.30	1.22	ND	< 10	ND	< 5	15.1	19.5	ND	< 10	25	35

TABLE 2.--RADIOACTIVITY IN MILK

Public Health Service Milk Monitoring Program
Processed Milk Area Sampling Stations

October 1960

(Radioactivity in μμc/liter)

Area	Calcium (grams/liter)		Strontium-89		Strontium-90		Cesium-137	
	October	Average** to date	October	Average** to date	October	Average** to date	October	Average** to date
Albuquerque, N Mex.	1.05	1.11	ND	<5	2	4	ND	< 5
Atlanta, Ga.	1.22	1.23	ND	<5	10	11	ND	< 5
Austin, Texas	*	1.13	*	<5	*	2	*	5
Baltimore, Md.	1.20	1.12	ND	<5	8	7	ND	< 5
Boston, Mass.	1.22	1.18	ND	<5	10	12	ND	15
Buffalo, N. Y.	1.12	1.17	ND	<5	4	7	ND	5
Burlington, Vt.	1.23	1.19	ND	<5	6	9	ND	10
Charleston, S. C.	1.24	1.22	ND	<5	12	11	ND	10
Charleston, W. Va.	1.19	1.16	ND	<5	9	9	ND	< 5
Charlotte, N. C.	1.28	1.21	ND	<5	12	12	ND	10
Chattanooga, Tenn.	1.31	1.29	ND	<5	11	11	ND	< 5
Chicago, Ill.	1.18	1.13	ND	<5	4	6	ND	< 5
Cincinnati, O.	1.20	1.17	ND	<5	6	8	ND	< 5
Cleveland, O.	1.23	1.13	ND	<5	6	8	ND	< 5
Dallas, Texas	1.23	1.23	ND	<5	6	6	ND	< 5
Denver, Colo.	1.10	1.10	ND	<5	5	6	10	10
Detroit, Mich.	1.21	1.15	ND	<5	5	7	ND	< 5
Des Moines, Iowa	1.12	1.04	ND	<5	7	7	20	20
Grand Rapids, Mich.	1.26	1.22	ND	<5	7	8	ND	< 5
Hartford, Conn.	1.24	1.16	ND	<5	8	9	ND	10
Helena, Mont.	0.96	1.05	ND	<5	8	7	ND	15
Honolulu, Hawaii	1.10	1.06	ND	<5	5	5	20	35
Indianapolis, Ind.	1.20	1.17	ND	<5	6	6	ND	< 5
Idaho Falls, Idaho	1.15	1.06	ND	<5	5	5	10	25
Jackson, Miss.	1.30	1.26	ND	<5	10	11	ND	< 5
Kansas City, Mo.	1.02	1.07	ND	<5	8	8	10	10
Laramie, Wyo.	0.99	1.05	ND	<5	4	5	ND	< 5
Las Vegas, Nev.	0.97	1.05	ND	<5	2	2	ND	< 5
Little Rock, Ark.	1.22	1.21	ND	<5	12	13	ND	< 5
Louisville, Ky.	1.21	1.18	ND	<5	8	8	ND	< 5
Manchester, N. H.	1.23	1.22	ND	<5	8	12	ND	30
Memphis, Tenn.	1.23	1.22	ND	<5	10	12	ND	< 5
Milwaukee, Wis.	1.12	1.14	ND	<5	6	6	ND	< 5
Minneapolis, Minn.	1.11	1.03	ND	<5	8	9	ND	< 5
New Orleans, La.	1.30	1.25	ND	<5	12	15	ND	< 5
New York, N. Y.	1.14	1.11	ND	<5	8	9	ND	10
Norfolk, Va.	1.23	1.18	ND	<5	9	9	ND	< 5
Oklahoma City, Okla.	1.21	1.17	ND	<5	8	8	ND	< 5
Omaha, Nebr.	1.11	1.05	ND	<5	5	7	ND	< 5
Palmer, Alaska	1.10	1.07	ND	<5	8	7	ND	< 5
Philadelphia, Pa.	1.17	1.14	ND	<5	6	9	ND	10
Phoenix, Ariz.	1.00	1.00	ND	<5	2	4	30	20
Pittsburgh, Pa.	1.20	1.21	ND	<5	10	13	ND	10
Portland, Me.	1.21	1.14	ND	<5	10	12	ND	20
Portland, Ore.	1.16	1.10	ND	<5	9	10	20	45
Providence, R. I.	1.24	1.17	ND	<5	10	12	ND	10

See footnotes at end of table.

TABLE 2.--RADIOACTIVITY IN MILK--Con.

Public Health Service Milk Monitoring Program
Processed Milk Area Sampling Stations

October 1960

(Radioactivity in μμc/liter)

Area	Calcium (grams/liter)		Strontium-89		Strontium-90		Cesium-137	
	October	Average** to date	October	Average** to date	October	Average** to date	October	Average** to date
Sacramento, Calif.	1.01	1.03	ND	<5	5	5	ND	<5
Salt Lake City, Utah	0.94	1.08	ND	<5	4	6	ND	<5
San Francisco, Calif.	1.15	1.09	ND	<5	4	4	ND	10
San Juan, P.R.	1.22	1.15	ND	<5	3	4	ND	<5
Seattle, Wash.	1.06	1.08	ND	<5	6	9	30	45
Spokane Wash.	1.08	1.06	ND	<5	5	7	30	30
St. George, Utah	1.09	1.01	ND	<5	3	5	ND	<5
St. Louis, Mo.	1.08	1.04	ND	<5	6	6	50	50
Syracuse, N. Y.	1.20	1.22	ND	<5	6	7	ND	10
Tampa, Fla.	1.24	1.24	ND	<5	6	5	75	80
Trenton, N. J.	1.26	1.17	ND	<5	8	8	ND	5
Washington, D. C.	1.12	1.13	ND	<5	6	8	ND	<5
Wichita, Kansas	1.00	1.07	ND	<5	4	6	ND	<5
Wilmington, Del.	1.21	1.20	ND	<5	8	9	ND	10

ND--No detectable activity.
*Sample lost during analysis.
**Because this program was initiated in 1960 and sampling stations necessarily became operative in a staggered sequence, the averages shown represent all samples taken to date. Averages will normally be for the latest 12 month period after sampling began. For the October data, the average covers a period of one to eight months.

RADIOACTIVITY IN MILK

Health and Safety Laboratory
U. S. Atomic Energy Commission

The data for the Atomic Energy Commission Health and Safety Laboratory's routine milk monitoring program at four locations in the United States for July and August 1960 are presented in table 1. Data for previous months appear in Radiological Health Data, Volume I, Numbers 1, 2, 3, 5, 7 and 8.

TABLE 1.--STRONTIUM-90 AND CALCIUM IN MILK SAMPLES

Atomic Energy Commission

Sampling station Month 1960	Strontium-90			Calcium	
	uuc/liter	uuc/kg	uuc/gmCa	gm/liter	gm/kg
Perry, N. Y.					
(Powdered milk)					
July		69.8	7.7		9.0
August		78.8	8.6		9.1
New York City					
(Liquid milk)					
July	10.2		9.8	1.0	
August	8.7		8.6	1.0	
Mandan, N. Dakota					
(Powdered buttermilk)					
July		80.8	9.6		8.4
August		99.2	10.0		9.9
Honolulu, Hawaii					
(Liquid milk)					
July*	3.7		3.6	1.0	
	2.5		2.4	1.0	
August*	4.2		3.8	1.1	
	2.6		2.5	1.1	

*Two results per month representing milk from two different dairies.

SECTION IV.—WATER

PUBLIC HEALTH SERVICE NATIONAL WATER QUALITY NETWORK

The National Water Quality Network was established under the provision of Section 4 (c) of Public Law 660, which states "...The Surgeon General shall ...collect and disseminate basic data ...(relating) to water pollution and the prevention and control thereof."

This Network, operated in cooperation with State and local health agencies, was started in October 1957. At present there are 75 sampling stations located on major waterways used for public water supply, propagation of fish and wildlife, recreational purposes, and for agricultural, industrial and other uses; some of these stations are on interstate, coastal, and International Boundary waters, and waters on which activities of the Federal Government may have an impact. Ultimately a total of 250 to 300 stations will be in operation. A few of the more recently established stations have not begun to report radioactivity.

Samples of water are examined for chemical, physical and biological quality insofar as these relate to pollution. Samples for some determinations are taken weekly, others monthly, and for some continuous composite samples for 10 to 15 days are obtained.

Gross alpha and beta measurements are made on both suspended and dissolved solids in the raw surface water samples. The radioactivity levels of dissolved solids provide a rough measure of the levels which may be found in a treated water, where such water treatment removes substantially all of the suspended matter. Naturally occuring radioactive substances in the environment are the source of essentially all of the alpha activity. The contamination of the environment from man-made sources is the major contributor to the beta activity. It should be noted that with the cessation of weapons testing, beta activity in most raw waters is generally approaching a level attributable solely to natural beta activity. Natural beta activity can be two or three times the natural alpha activity based on the presence of the same nuclides. Some exceptions to this are seen, notably the data for the Columbia River and the Animas River. The results are reported in micromicrocuries per liter and are shown for each station on a given river.

While beta determinations for the first two years of the Network operation have been conducted weekly on each sample, the alpha determinations are reported generally on a composite sample of more than one week. Beginning with samples taken in January 1960, beta determinations were performed on composite samples obtained by combining two weekly samples. The alpha data are reported on three-month composite samples, with 1/3 of the stations being covered each month. All the data reported in table 1 represent the average of all information available for the month indicated.

Strontium-90 data reported are the results of determinations on composite samples for a three-month period ending in the month shown.

Additional information and data may be obtained from the following sources:

1. "National Water Quality Network Annual Compilation of Data," PHS Publication. For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price $1.50.

2. "Report on National Water Quality Control Network," submitted by Dr. F. J. Weber, Chief, Division of Radiological Health, PHS, at the Joint Committee on Atomic Energy Hearings on Fallout from Nuclear Weapons Tests, Vol. 1, May 1959, pages 167-169.

PUBLIC HEALTH SERVICE NATIONAL WATER QUALITY NETWORK
SAMPLING STATIONS

As of June 30, 1960

FIGURE 1

TABLE 1.—RADIOACTIVITY IN RAW SURFACE WATERS

Public Health Service National Water Quality Network

(Average concentrations in μμc/liter)

Station	Quarter ending Sept. 30, 1960	September 1960					
	Strontium-90	Beta activity			Alpha activity		
		Susp.	Diss.	Total	Susp.	Diss.	Total
ANIMAS RIVER							
Cedar Hill, N. Mex.	0.4	0	24	24	2	22	24
APALACHICOLA RIVER							
Chattahoochie, Fla.	0.5	0	0	0	0	0	0
ARKANSAS RIVER							
Coolidge, Kans.	0.8	-	-	-	-	-	-
CHATTAHOOCHIE RIVER							
Atlanta, Ga.	-	0	0	0	0	0	0
Columbus, Ga.	-	0	0	0	0	0	0
COLORADO RIVER							
Loma, Colo.	-	0	8	8	1	20	21
Page Ariz.	-	47	34	81	25	40	65
Hoover Dam, Ariz.-Nev.	1.0	1	16	17	0	0	0
Yuma, Ariz.	-	0	7	7	1	7	8
COLUMBIA RIVER							
Pasco, Wash.	-	35	513	548	-	-	-
Wenatchee, Wash.	-	0	0	0	-	-	-
Bonneville Dam, Ore.	-	2	291	293	-	-	-
Clatskanie, Ore.	0.3	-	-	-	-	-	-
DELAWARE RIVER							
Martin's Creek, Pa.	-	2	0	2	-	-	-
Philadelphia, Pa.	-	0	0	0	3	1	4
ESCAMBIA RIVER							
Century, Fla.	-	16	0	16	3	1	4
GREAT LAKES							
Gary, Ind.	0.5	0	0	0	1	0	1
Duluth, Minn.	-	0	0	0	0	1	1
Detroit, Mich.	-	0	2	2	0	1	1
Buffalo, N. Y.	-	0	0	0	-	-	-
Milwaukee, Wisc.	-	< 1	5	5	0	1	1
HUDSON RIVER							
Poughkeepsie, N. Y.	0.1	0	0	0	0	1	1
ILLINOIS RIVER							
Peoria, Ill.	0.3	0	2	2	1	3	4
KANAWHA RIVER							
Winfield Dam, W. Va.	-	0	3	3	0	0	0

TABLE 1.--RADIOACTIVITY IN RAW SURFACE WATERS--Con.

Public Health Service National Water Quality Network

(Average concentrations in μμc/liter)

Station	Quarter ending Sept. 30, 1960	September 1960					
	Strontium-90	Beta activity			Alpha activity		
		Susp.	Diss.	Total	Susp.	Diss.	Total
MISSISSIPPI RIVER							
Red Wing, Minn.	1.4	-	-	-	-	-	-
Dubuque, Iowa	-	0	0	0	0	1	1
East St. Louis, Ill.	-	0	0	0	0	3	3
Cape Girardeau, Mo.	0.9	13	3	16	1	8	9
West Memphis, Ark.	-	5	4	9	1	2	3
Delta, La.	-	0	0	0	-	-	-
New Orleans, La.	-	0	14	14	0	2	2
MISSOURI RIVER							
Williston, N. D.	-	7	0	7	-	-	-
Yankton, S. D.	-						
Omaha, Nebr.	-	10	5	15	-	-	-
St. Joseph, Mo.	-	14	1	15	-	-	-
Kansas City, Kans.	-	7	5	12	14	6	20
St. Louis, Mo.	1.2	22	0	22	-	-	-
OHIO RIVER							
East Liverpool, Ohio	0.4	-	-	-	-	-	-
Wheeling, W. Va.	0.5	0	2	2	1	< 1	2
Huntington, W. Va.	-	2	6	8	0	0	0
Cincinnati, Ohio	-	0	7	7	0	1	1
Evansville, Ind.	-	0	0	0	-	-	-
Cairo, Ill.	0.4	-	-	-	-	-	-
RED RIVER, NORTH							
Grand Forks, N. D.	(*)	6	16	22	< 1	3	3
RED RIVER, SOUTH							
Denison, Tex.	-	0	0	0	-	-	-
Index, Ark.	-	2	11	13	4	2	6
Alexandria, La.	1.1	-	-	-	-	-	-
RIO GRANDE RIVER							
El Paso, Tex.	-	4	3	7	2	21	23
Brownsville, Tex.	0.3	0	0	0	-	-	-
SABINE RIVER							
Ruliff, Tex.	-	< 1	1	1	1	< 1	2
ST. CLAIR RIVER							
Port Huron, Mich.	0.6	0	24	24	0	1	1
ST. LAWRENCE RIVER							
Massena, N. Y.	-	< 1	3	4	0	< 1	< 1
ST. MARY'S RIVER							
Sault Ste. Marie, Mich.	-	0	0	0	0	0	0

See footnotes at end of table.

TABLE 1.--RADIOACTIVITY IN RAW SURFACE WATERS--Con.

Public Health Service National Water Quality Network

(Average concentrations in μμc/liter)

Station	Quarter ending Sept. 30, 1960	September 1960					
	Strontium-90	Beta activity			Alpha activity		
		Susp.	Diss.	Total	Susp.	Diss.	Total
SCHUYLKILL RIVER							
Philadelphia, Pa.	-	0	0	0	1	0	1
SAVANNAH RIVER							
Port Wentworth, Ga.	0.8	0	75	75	0	0	0
SNAKE RIVER							
Wawawai, Wash.	0.5	-	-	-	-	-	-
SUSQUEHANNA RIVER							
Sayre, Pa.	0.3	0	2	2	< 1	1	1
Conowingo, Md.	0.3	0	4	4	0	< 1	< 1
TENNESSEE RIVER							
Chattanooga, Tenn.	0.6	0	12	12	1	1	2
YELLOWSTONE RIVER							
Sidney, Mont.	-	0	0	0	-	-	-

*Insufficient sample for analysis.

SECTION V.—OTHER DATA

EXTERNAL GAMMA ACTIVITY

Public Health Service Radiation Surveillance Network

Portable survey instruments are available at stations of the Radiation Surveillance Network for recording levels of external gamma radiation. Measurements are made daily approximately three feet above the ground. These readings are not precise but are sufficiently accurate to illustrate any significant variations above background. The differences among the values shown in the following table are within the variance anticipated due to differences in normal background and in instrument response characteristics.

TABLE 1.--EXTERNAL GAMMA ACTIVITY

Public Health Service Radiation Surveillance Network

October 1960

Station Location	Average (mr/hr)	Station Location	Average (mr/hr)
Alaska, Anchorage	0.01	Mississippi, Pascagoula	(*)
Alaska, Fairbanks	(*)	Missouri, Jefferson City	0.01
Alaska, Juneau	0.02	Montana, Helena	0.03
Arizona, Phoenix	0.01	New Jersey, Trenton	(*)
Arkansas, Little Rock	0.01	New Mexico, Santa Fe	0.04
California, Berkeley	0.01	New York, Albany	0.01
California, Los Angeles	0.01	North Carolina, Gastonia	0.02
Colorado, Denver	(*)	Ohio, Cincinnati	(*)
Connecticut, Hartford	0.01	Oklahoma, Oklahoma City	0.02
District of Columbia	0.02	Oklahoma, Ponca City	0.04
Florida, Jacksonville	0.01	Oregon, Portland	0.02
Georgia, Atlanta	(*)	Pennsylvania, Harrisburg	0.01
Hawaii, Honolulu	0.03	Rhode Island, Providence	0.02
Idaho, Boise	0.01	South Carolina, Columbia	0.02
Illinois, Springfield	0.01	South Dakota, Edgemont	(*)
Indiana, Indianapolis	0.01	South Dakota, Pierre	0.02
Iowa, Iowa City	0.01	Texas, Austin	0.01
Kansas, Topeka	0.02	Texas, El Paso	0.02
Louisiana, New Orleans	0.01	Utah, Salt Lake City	0.02
Maryland, Baltimore	0.02	Virginia, Richmond	0.01
Massachusetts, Lawrence	0.02	Washington, Seattle	0.02
Michigan, Lansing	0.02	Wyoming, Cheyenne	0.02
Minnesota, Minneapolis	0.01		

* No data received

SOIL DATA

Argonne National Laboratory
U. S. Atomic Energy Commission

Fission product radioactivity at the Argonne National Laboratory, Lemont, Illinois for September 1960 has been reported by Dr. Philip F. Gustafson. Previous data has been reported in Radiological Health Data, Volume I, Numbers 1, 2, 4, 9 and Volume II, Number 1.

Isotope	September 30, 1960 (mc/mi^2)
Zr^{95}--Nb^{95}	0
Cs^{137}	195
Ru^{106}	755
Ce^{144}	1100
Total	2050
Dose-rate ($\mu rads/hr$) *	1.33

* Calculated dose-rate at one meter above ground surface. No correction is made for shielding effect of structures.

ENVIRONMENTAL LEVELS OF RADIOACTIVITY AT ATOMIC ENERGY COMMISSION INSTALLATIONS

The United States Atomic Energy Commission is providing data on environmental levels of radioactivity in the vicinity of major Commission installations to the Public Health Service on a quarterly basis. The data are from routine monitoring programs where operations are of such a nature that plant perimeter surveys are required.

Radiological Health Data, Volume I, Numbers 8 and 9, and Volume II, Numbers 1 and 2, contained summaries for 16 installations. Reports on four of the installations, covering the second and third quarters of 1960, follow.

MOUND LABORATORY

Monsanto Chemical Company
Miamisburg, Ohio

Issued August and December 1960

Environmental levels of radioactivity at Mound Laboratory for 1959 and the first quarter 1960 were reported in Radiological Health Data, Volume I, Number 8. The following report presents the data for the second and third quarters of 1960.

During the period covered by this report, no radioactive materials were used which contributed any measurable gamma or hard beta emitters to the environment.

Polonium, plutonium and tritium are possible air contaminants; polonium and tritium are possible river water contaminants.

Water Monitoring

Liquid radioactive waste materials from polonium work at the Laboratory are processed in a special waste disposal plant. Here, levels of radioactivity are reduced to an acceptable concentration for

discharge into the Great Miami River. Liquid waste from plutonium work is small in volume. It is handled separately as a packaged waste and not discharged to the river. The purification of helium-3 yeilds small quantities of tritium. Liquid waste from this work, also small in volume, is treated separately (diluted with water when necessary) to assure that the radioactive content is within the maximum permissible concentration prior to discharge into the Great Miami River.

Samples are collected routinely each week from the Laboratory effluent stream at the point of discharge and in the Great Miami River downstream to a distance of five miles. Once each quarter, river water samples are collected at various locations between Franklin, Ohio, and Elizabethtown, Ohio, where the Great Miami River enters the Ohio River. A weekly water sample is also collected from a drainage ditch which runs through the plant site. This ditch carries off all storm sewer water, which eventually empties into the river. The treated liquid tritium waste is discharged into the storm sewers; the waste disposal plant effluent is discharged directly into the river via a closed sewer line. All of the samples collected from the river are analyzed to determine the polonium concentration. The drainage ditch sample and part of the river samples are analyzed for tritium concentration.

The data presented in table 1 indicate that the concentrations of polonium and tritium in the Great Miami River are well within the maximum permissible continuous concentration.

Refer to the "Water Sample Locations," figure 1, to determine the location of the data presented in table 1.

Air Monitoring

Monitoring of the environmental air for tritium concentration by means of a continuous air monitor mounted in a panel truck was performed routinely out to a distance of five miles from the Laboratory. The concentration of this isotope in the environment has been immeasurable to date.

Monitoring for possible polonium and plutonium in the environment is accomplished by particulate air sampling equipment also mounted in the panel truck used for tritium air sampling. A long-lived gross alpha determination on filter paper samples was made only after sufficient time had elapsed after collection to permit the decay of short-lived daughter products of radon and thoron.

The concentration of alpha activity detected in the environment was very low. At the low concentrations detected, the isotopes of polonium and plutonium are not distinguishable from each other or from the natural background radioactivity in the air. The polonium effluent stack monitoring program for these quarters has shown essentially no detectable polonium in the environment due to the operations at Mound Laboratory should be expected.

Comparing the gross alpha detected in the air to the maximum permissible continuous concentration for plutonium in the environment, and assuming that all alpha activity detected is plutonium, it is found that the average plutonium concentration is well within permissible concentration; however, it is a significant per cent of the permissible concentration. In order to determine the impact of the Mound Laboratory plutonium work on the environment, it is pointed out that the natural background concentration of alpha contamination in the air in southwestern Ohio is in the range of, and frequently exceeds, the very low permissible concentration for plutonium. The normal gross alpha (long-lived) count in the environment is usually a very significant per cent of, and frequently exceeds, the permitted alpha count for plutonium if the total count is attributed to plutonium. The impact of plutonium work at Mound Laboratory is also placed in proper focus by referring to our plutonium stack monitoring data. During the third quarter of 1960, the average concentration of plutonium in air discharged from the stack was well within the permissible concentration for environmental air. For this reason, and the fact that the air is discharged to the environment from a 200 foot stack at a high velocity yeilding a high dilution factor, the plutonium operations (as well as the polonium work) have contributed an insignificant burden to the radioactivity normally present in the atmosphere.

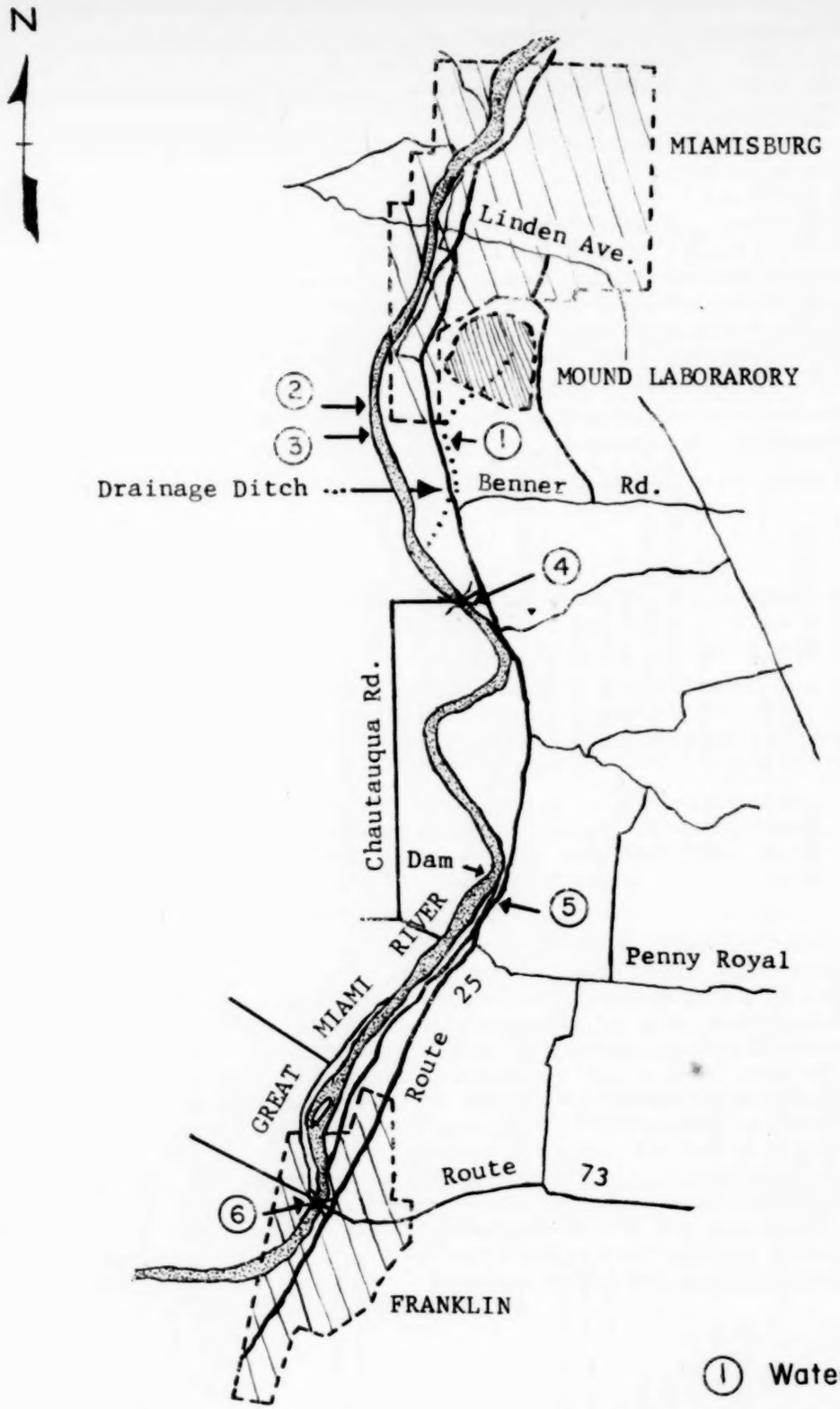
TABLE 1.--SUMMARY OF MONITORING FOR RADIOACTIVITY IN GREAT MIAMI RIVER

(Average concentrations in μμc/liter)

Location description	Second quarter 1960		Third quarter 1960				
	Concentration	%MPC*	Location		Number samples	Concentration	%MPC*
			Number	Description			
Polonium (all river samples):							
Mound Lab effluent	662.2		2	Mound Lab effluent	12	236	33.7
200 yards downstream	1.2	0.17	3	250 yards downstream	12	1.1	.15
250 yards downstream	.9	0.13	4	Chautauqua Rd. Bridge	11	.8	.12
300 yards downstream	.8	0.11	5	Chautauqua Dam	12	.4	.06
1 mile downstream	1.8	0.43	6	Franklin, Ohio	11	3.4	.49
2 miles downstream	2.1	0.50		Trenton, Ohio	1	N.D.	
5 miles downstream	.2	0.05		New Miami, Ohio	1	N.D.**	0
				7 miles N. of New Baltimore, Ohio	1	N.D.	0
				New Baltimore, Ohio	1	N.D.	0
				Miamitown, Ohio	1	N.D.	0
				5 miles N. of Elizabethtown, Ohio	1	N.D.	0
				Elizabethtown, Ohio	1	N.D.	0
Tritium (drainage ditch and river samples)	N.D.	0	1	Mound Lab drainage ditch	15	4.0×10^5	14
			2	Mound Lab effluent	13	N.D.	0
			4	Chautauqua Rd. Bridge	5	N.D.	0

* The values for MPC in water are 1/10 of the MPC allowed for continuous occupational exposure as given in Handbook 69, National Bureau of Standards, issued June 5, 1959.

** Not detectable by present instrumentation.



GREAT MIAMI RIVER WATER SAMPLING LOCATIONS

MOUND LABORATORY

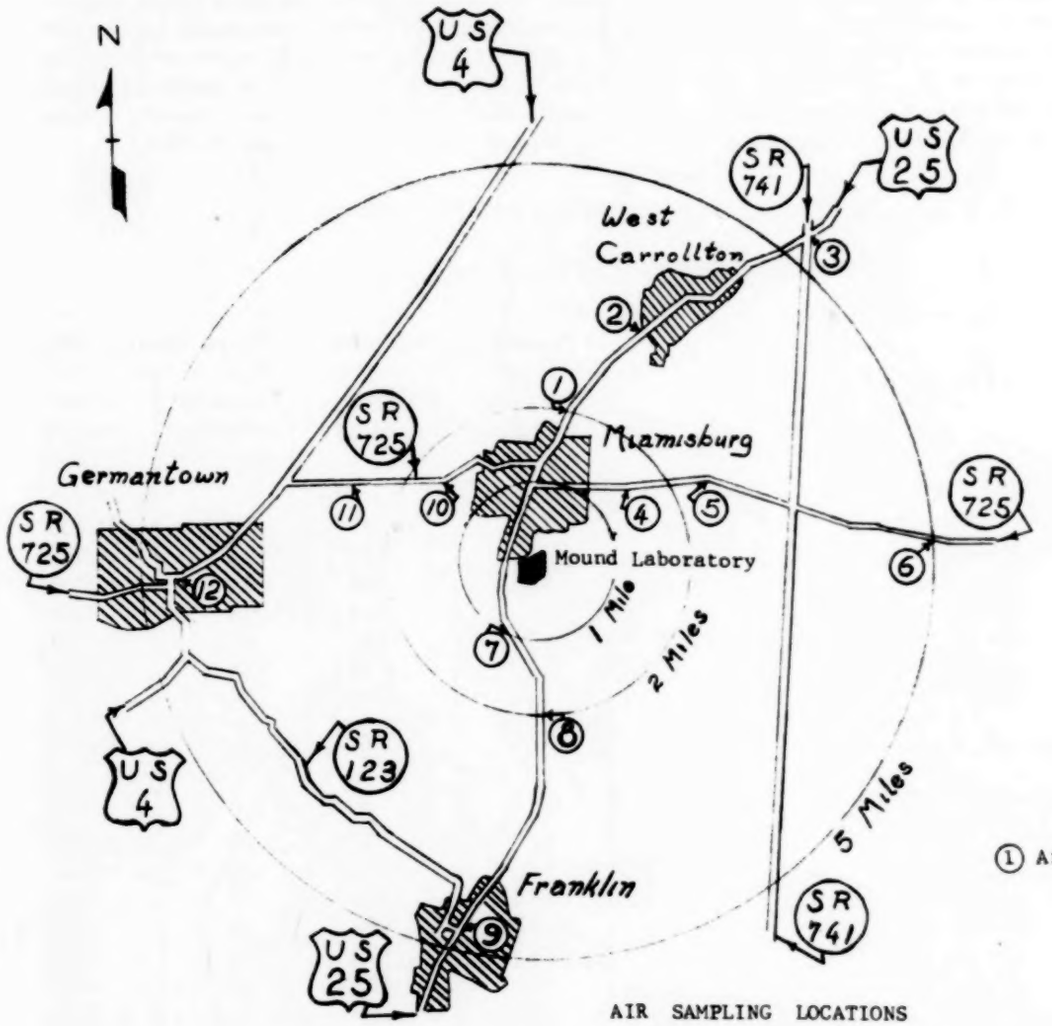
FIGURE I

TABLE 2.--GROSS ALPHA ACTIVITY IN AIR FROM POLONIUM AND PLUTONIUM

(Not including natural background)

Distance from Mound Laboratory	Second Quarter 1960			Third Quarter 1960		
	Number sampling locations	Number samples	Average concentration ($\mu\mu c/m^3$)	Number sampling locations	Number samples	Average concentration ($\mu\mu c/m^3$)
0-5 miles	12	131	0.0270	12	81	0.0116
5-15 miles	15	15	ND	10	10	.0303
5-30 miles				17	17	.0102
30-40 miles				9	9	.0090

ND--Not detectable by present instrumentation.



① Air Sampling Stations

AIR SAMPLING LOCATIONS
MOUND LABORATORY

FIGURE 2

OAK RIDGE NATIONAL LABORATORY

Union Carbide Nuclear Company
Oak Ridge, Tennessee

Issued November 1960

Environmental levels of radioactivity at Oak Ridge National Laboratory (ORNL) for 1959 and the first quarter 1960 were reported in the Radiological Health Data, Volume I, Number 9. The following report presents a summary of the data for the second and third quarters of 1960.

Radioactive waste materials arising from the operation of atomic energy installations at the ORNL are collected, treated and disposed of according to their physical states. Air that may have become contaminated by radioactive materials is exhausted to the atmosphere from several tall stacks after treatment by filtration, scrubbing and/or precipitation. Liquid wastes which contain long-lived fission products are confined in storage tanks or are released to earthen pits located in the Conasauga shale formation. Low level liquid wastes are discharged after preliminary treatment to the surface streams. Solid wastes are buried in a Conasauga shale formation. This shale has a marked ability to fix radioactive materials by an ion exchange mechanism.

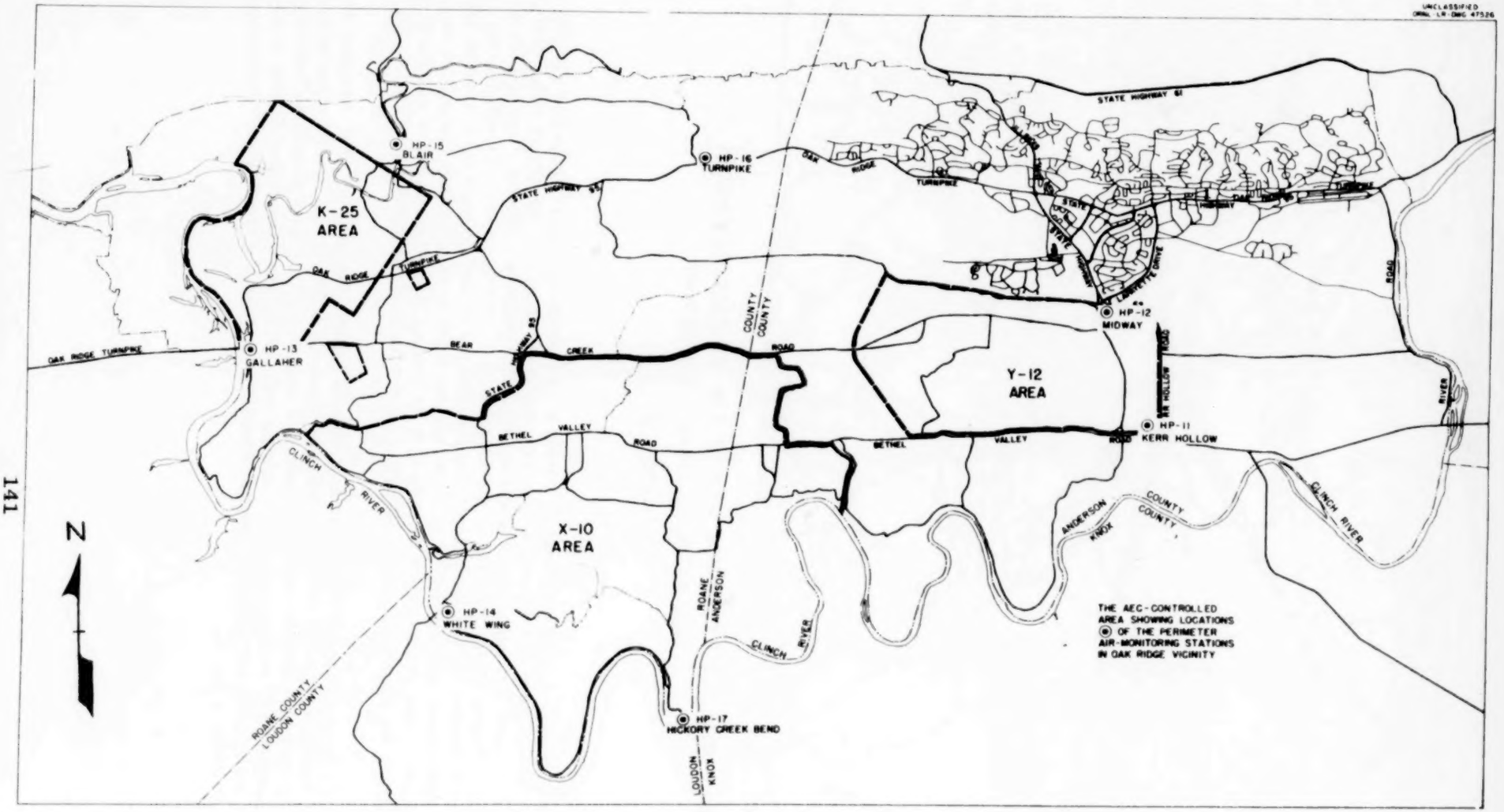
Air Monitoring

Atmospheric contamination and fallout occuring in the general environment of east Tennessee are monitored by two systems of sampling stations. One system consists of seven stations which encircle the plant areas (figure 1) and provides data for evaluating the impact of ORNL operations on the immediate environment. A second system consists of eight stations encircling the ORNL area at distances of from 12 to 120 miles (figure 2). This system provides data to aid in evaluating local conditions and to assist in determining the spread or dispersal of contamination should a major incident occur. Table 1 presents the data from the air monitoring program for the second and third quarters of 1960.

TABLE 1.—CONTINUOUS AIR MONITORING FILTER DATA

(Average concentrations in $\mu\mu c/m^3$)

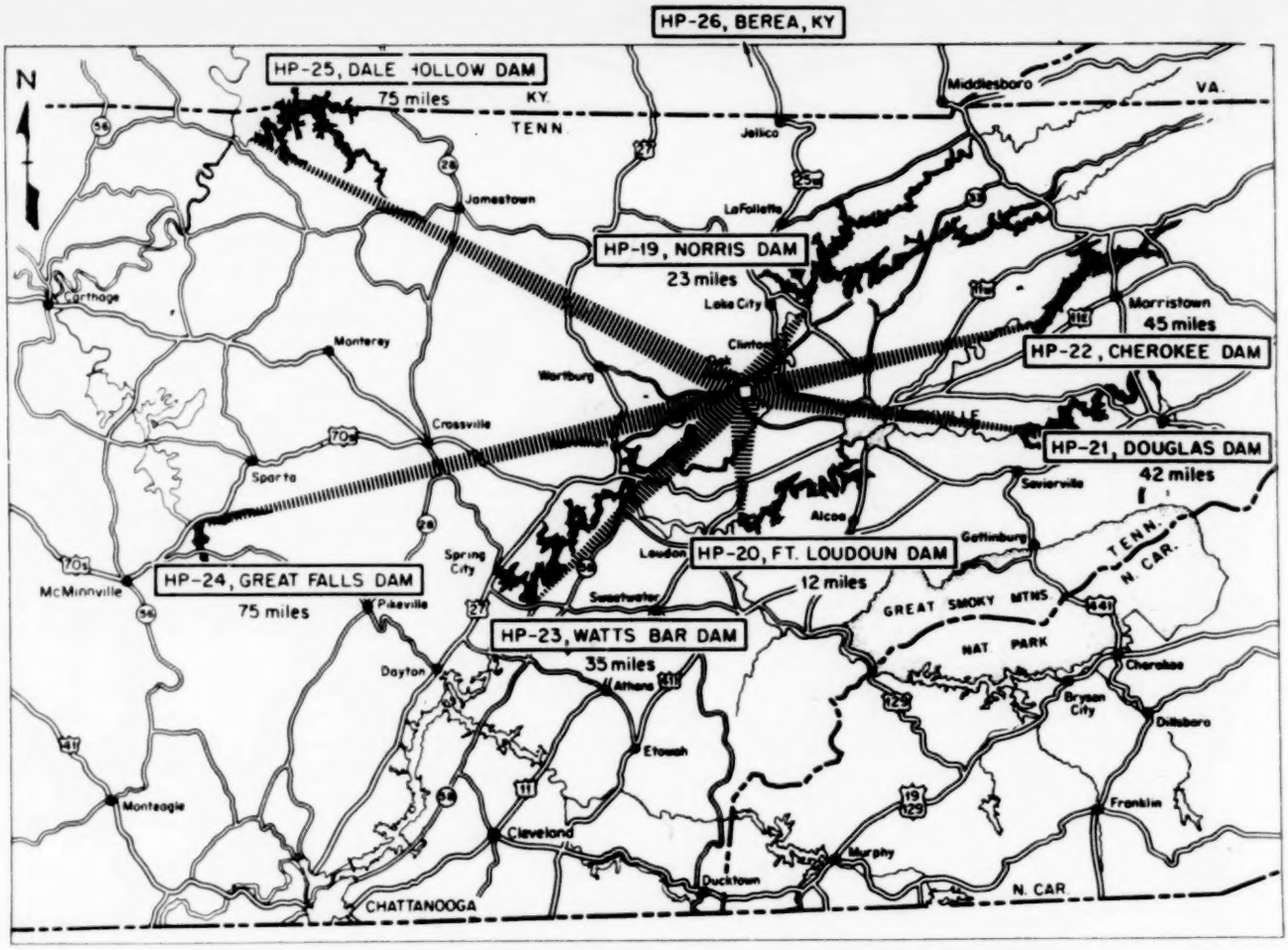
Station number	Second quarter 1960		Third quarter 1960	
	Number samples	Gross activity	Number samples	Gross activity
Perimeter stations:				
HP-11	13	0.149	14	0.103
HP-12	13	.195	14	.099
HP-13	13	.141	14	.060
HP-14	13	.104	14	.066
HP-15	13	.242	14	.111
HP-16	12	.130	14	.078
HP-17	13	.172	14	.078
Average		0.162		0.085
Remote stations:				
HP-19	13	0.177	13	0.082
HP-20	13	.191	13	.087
HP-21	13	.158	13	.080
HP-22	13	.154	13	.072
HP-23	13	.173	13	.088
HP-24	13	.189	13	.097
HP-25	13	.160	11	.066
HP-26	10	.093	12	.062
Average		0.162		0.080



PERIMETER AIR MONITORING STATIONS

OAK RIDGE NATIONAL LABORATORY

FIGURE 1



STATION SITES FOR REMOTE AIR MONITORING SYSTEM
OAK RIDGE NATIONAL LABORATORY

FIGURE 2

Water Monitoring

Large volumes of low level liquid wastes originating at Oak Ridge National Laboratory are discharged, after some preliminary treatment, into the Tennessee River system by way of White Oak Creek and the Clinch River. Liquid wastes originating at the Oak Ridge Gaseous Diffusion Plant and the Y-12 Plant are discharged to Poplar Creek and then to the Clinch River. Releases are controlled so that resulting average concentrations in the Clinch River comply with the maximum permissible levels for population in the neighborhood of a controlled area as recommended by the National Committee on Radiation Protection (NCRP). The concentration of radioactivity leaving White Oak Creek is measured and concentration values for the Clinch River are calculated on the basis of the dilution provided by the river.

Radioactive liquid wastes are sampled at the locations as shown in figures 3 and 4. Samples are taken in Poplar and White Oak Creeks and at a number of locations in the Clinch River beginning at a point above the entry of wastes into the river and ending at Center's Ferry near Kingston, Tennessee. Stream gauging operations are carried on continuously by the United States Geological Survey to obtain dilution factors for calculating the probable concentrations of wastes in the river. Water monitoring data are tabulated in tables 2 and 3.

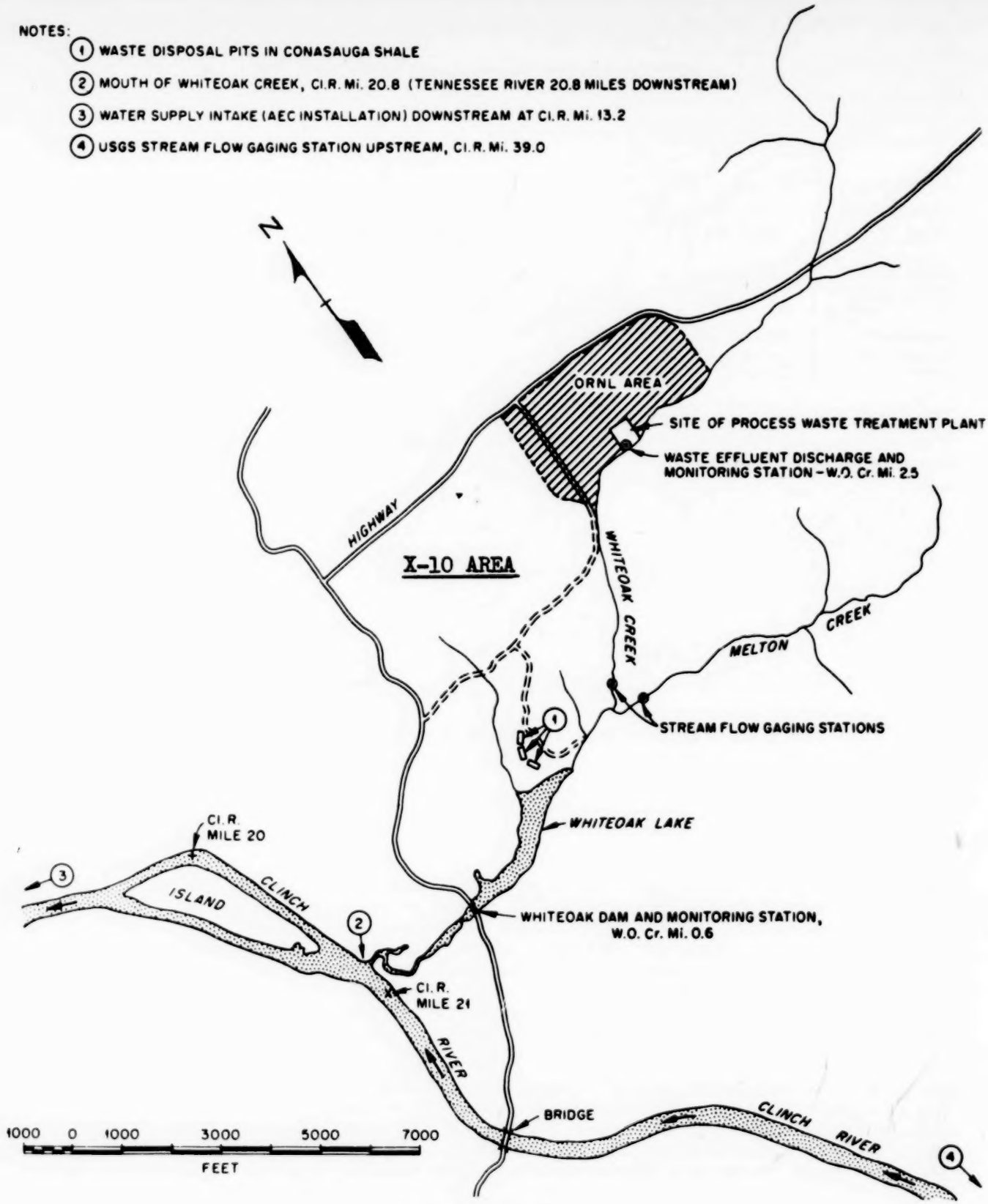
TABLE 2.--MAJOR RADIOACTIVE ELEMENTS IN THE CLINCH RIVER

(Average concentrations in μμc/liter)

Location	Sampling period	Sr^{90}	Ce^{144}	Cs^{137}	$Ru^{103-106}$	Co^{60}	Calculated concentrations gross beta
Upstream (mi. 37.5)	Second quarter	1	0.5	ND*	ND	ND	3
	Third quarter	1	0.6	ND	ND	ND	1
Point of entry (mi. 20.8)**	Second quarter	8	2.0	4.0	163	12	562
	Third quarter	7	1.0	5.0	63	6	215
Downstream (mi. 4.5)	Second quarter	7	0.9	0.6	91	0.5	118
	Third quarter	5	0.6	0.9	32	2	118

*Not detectable by present instrumentation.

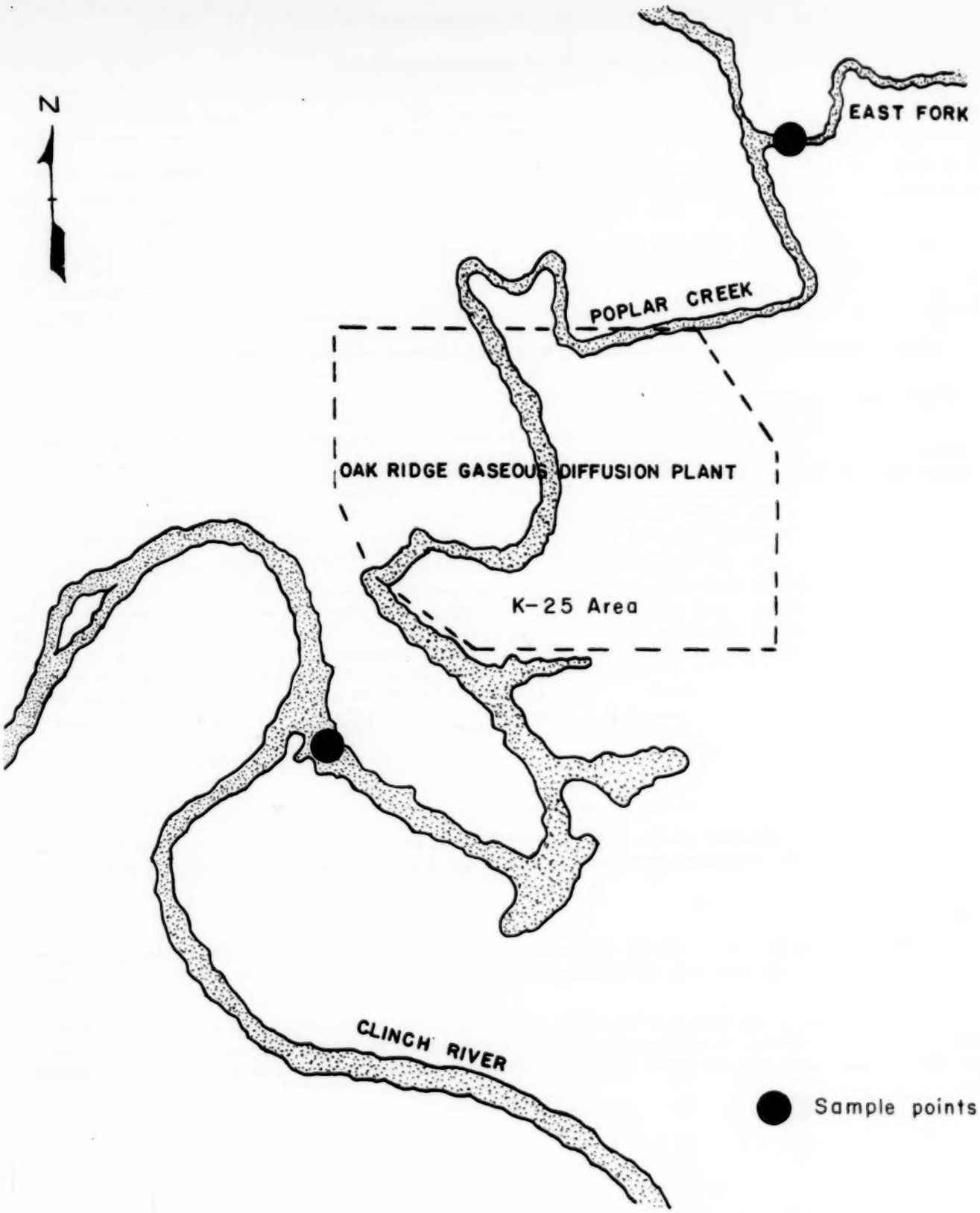
**Values given for this location are calculated values based on the levels of waste released and the dilution afforded by the river.


NOTES:
(1) WASTE DISPOSAL PITS IN CONASAUGA SHALE
(2) MOUTH OF WHITEOAK CREEK, Cl.R. Mi. 20.8 (TENNESSEE RIVER 20.8 MILES DOWNSTREAM)
(3) WATER SUPPLY INTAKE (AEC INSTALLATION) DOWNSTREAM AT Cl.R. Mi. 13.2
(4) USGS STREAM FLOW GAGING STATION UPSTREAM, Cl.R. Mi. 39.0
N
ORNL AREA
SITE OF PROCESS WASTE TREATMENT PLANT
WASTE EFFLUENT DISCHARGE AND MONITORING STATION – W.O. Cr. Mi. 2.5
HIGHWAY
X-10 AREA
WHITEOAK CREEK
MELTON CREEK
STREAM FLOW GAGING STATIONS
WHITEOAK LAKE
Cl.R. MILE 20
ISLAND
CLINCH
WHITEOAK DAM AND MONITORING STATION, W.O. Cr. Mi. 0.6
Cl.R. MILE 21
RIVER
BRIDGE
CLINCH RIVER
1000 0 1000 3000 5000 7000
FEET

LOCATION MAP

OAK RIDGE NATIONAL LABORATORY

FIGURE 3



WATER SAMPLING LOCATIONS
OAK RIDGE NATIONAL LABORATORY

FIGURE 4

TABLE 3.--CONCENTRATION OF RADIOACTIVITY IN POPLAR CREEK

(Average concentrations in μμc/liter)

Location	Second quarter 1960			Third quarter 1960		
	Number samples	Uranium	Beta	Number samples	Uranium	Beta
Upstream (East Fork)	13	57	71	13	19	65
Downstream (Outfall)	13	6	399	13	9	190

Normal sampling frequency: Continuous sampling composited over one week.

External Gamma Activity

External gamma radiation levels are measured monthly at five locations in the Oak Ridge area. Measurements are taken with a GM survey instrument at a distance of three feet above ground. The results are tabulated in table 4.

TABLE 4.—EXTERNAL GAMMA RADIATION LEVELS

(Average levels in mr/hr)

Period 1960	Location				
	Solway Gate	Y-12 East Portal	Newcomb Road Oak Ridge	Gallaher Gate	White Wing Gate
Second quarter	0.014	0.014	0.014	0.014	0.014
Third quarter	.014	.013	.014	.015	.017

External gamma radiation levels in the Oak Ridge area do not differ significantly from the average of the levels measured throughout the United States by the Public Health Service Radiation Surveillance Network.

Conclusions

From the data presented, it seems evident that the Oak Ridge Operations are contributing little to the air or ground contamination in the neighborhood of the area controlled by the Atomic Energy Commission.

Some radioactivity has been contributed to the Clinch River by the release of radioactive liquid wastes, but concentrations of radioactivity in the river are well below the maximum permissible concentration recommended by the NCRP for populations living in the vicinity of an atomic energy installation.

PADUCAH GASEOUS DIFFUSION PLANT

Union Carbide Nuclear Company
Paducah, Kentucky

Issued December 1960

Environmental levels of radioactivity at the Paducah Gaseous Diffusion Plant for 1959 and the first quarter 1960 were reported in Radiological Health Data, Volume I, Number 9. The following report presents a summary of the data for the second and third quarters of 1960.

The Paducah Plant is a government-owned gaseous diffusion plant operated by Union Carbide Nuclear Company for the Atomic Energy Commission. The diffusion plant, with the associated uranium hexafluoride manufacturing plant and uranium metal foundry, processes large quantities of relatively pure uranium compounds. The major sources of external penetrating radiation from such materials are the daughter products, isotopes of thorium and protactinium, formed by the alpha decay and subsequent beta decay of the parent uranium. These isotopes are concentrated in the ash produced during the fluorination process. The element uranium can be a physiological hazard only if it enters the body. The chemical toxicity of the uranium materials processed at the Paducah Plant overshadows any radiation danger from this element, making it comparable as a physiological risk to lead, mercury or other well known heavy metals.

Uranium is a rather expensive material, and this represents a great incentive to recover as much in any situation as is economically feasible. The added desire to maintain a wholesome relationship with neighboring communities and individuals makes it essential that all waste air be exhausted through filters and that all effluent waters be maintained at extremely low concentrations of uranium.

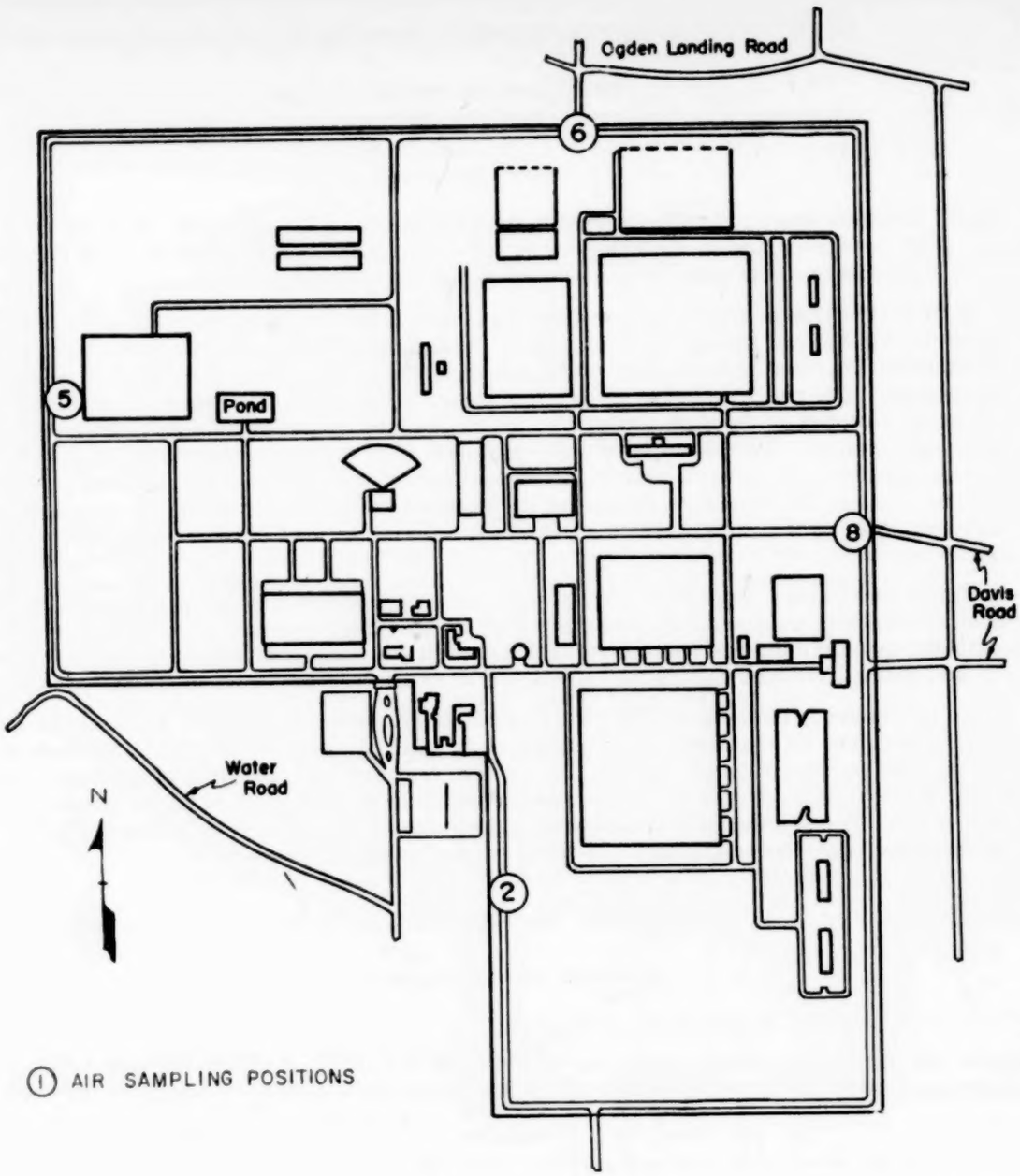
Since no recovery process or filtering system is 100 percent efficient, an environmental monitoring program is required to evaluate the effectiveness of such measures. The Paducah Plant environmental monitoring program consists of a continuing system for sampling the air at 4 stations around the plant perimeter fence and the water at 2 locations in the Big Bayou Creek, 1 in Little Bayou Creek, and 4 in the Ohio River. The results of this monitoring program are presented in tables 1 and 2. Figures 1 and 2 show the locations of air and water sampling points, respectively.

TABLE 1.--GROSS AIR ACTIVITY

(Average concentrations in $\mu\mu c/m^3$)

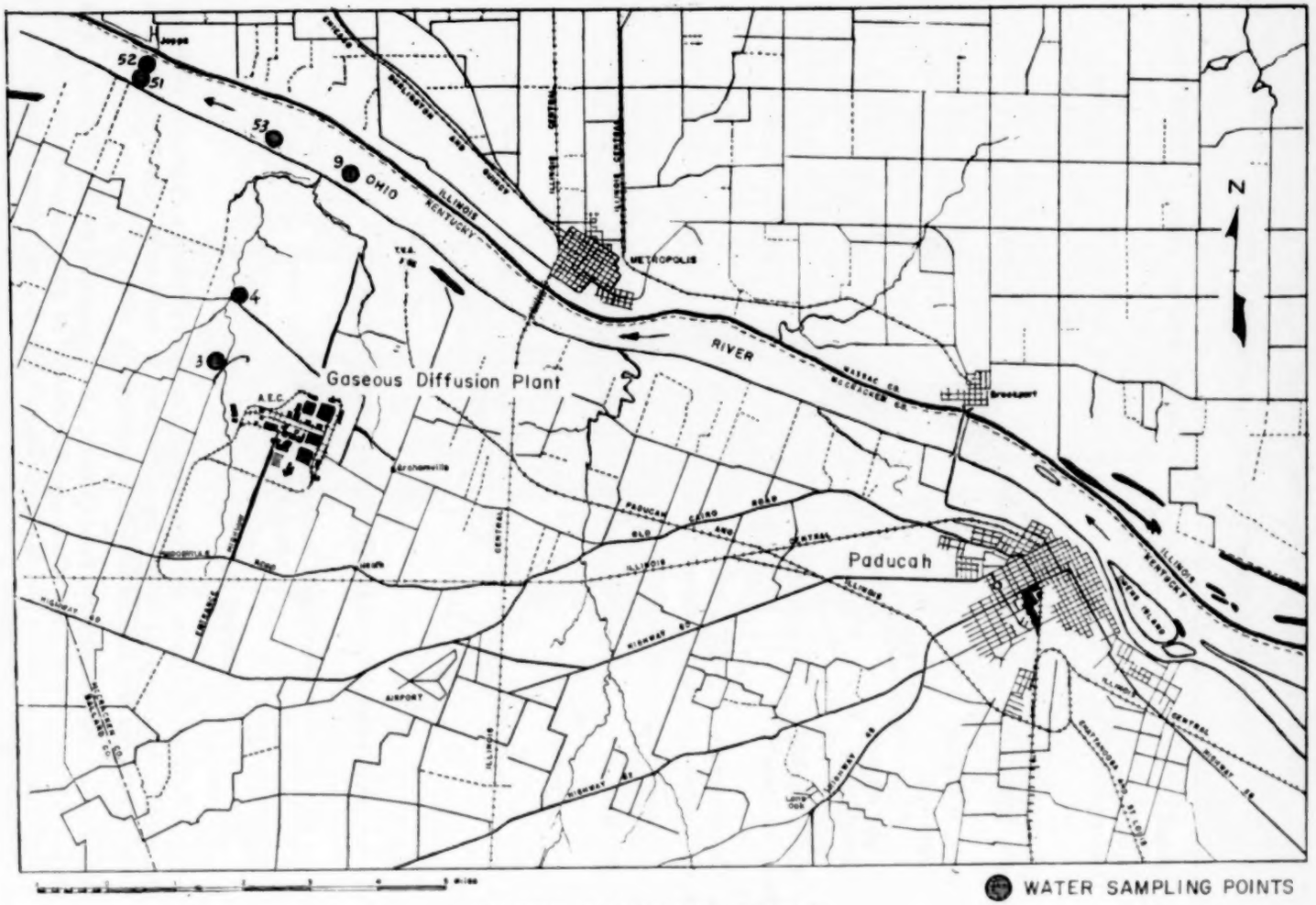
Location number	Type of analysis	Second quarter 1960		Third quarter 1960	
		Number samples	Average	Number samples	Average
2	Uranium*	10	0.25	10	0.27
	Gross beta	10	1.25	10	1.19
5	Uranium	10	.30	10	.22
	Gross beta	10	.59	10	1.17
6	Uranium	10	.57	10	.48
	Gross beta	10	4.74	10	3.40
8	Uranium	10	.31	10	.33
	Gross beta	10	3.39	10	1.79

*The micromicrocurie ($\mu\mu c$) for recently extracted uranium as defined in NBS Handbook 69, page 14, paragraph 3.2 is that amount of U^{238}, U^{235} and U^{234} which emits alpha particles at a rate of 0.0749 dis/sec.



AIR SAMPLING POSITIONS
PADUCAH GASEOUS DIFFUSION PLANT

FIGURE 1



WATER SAMPLING POINTS
PADUCAH GASEOUS DIFFUSION PLANT

FIGURE 2

TABLE 2.--GROSS STREAM WATER ACTIVITY

(Average Concentrations in uuc/liter)

Location		Type of analysis	Second quarter 1960		Third quarter 1960	
No.	Description		Number samples	Average	Number samples	Average
3	Big Bayou leaving Gov't. land	Uranium	13	13	14	17
		Gross beta	13	800	14	500
4	Big Bayou at Ogden Bridge Road	Uranium	3	10	3	7
		Gross beta	3	300	3	500
9	Ohio River above Paducah Plant	Uranium	6	1	6	1
		Gross beta	6	500	6	200
53	Ohio River--below Paducah Plant	Uranium	6	1	6	1
		Gross beta	6	800	6	400
51	Ohio River--south side at Joppa	Uranium	6	1	6	1
		Gross beta	6	1100	6	300
52	Ohio River--middle at Joppa	Uranium	6	1	6	1
		Gross beta	6	700	6	200

PORTSMOUTH GASEOUS DIFFUSION PLANT

Goodyear Atomic Corporation
Portsmouth, Ohio

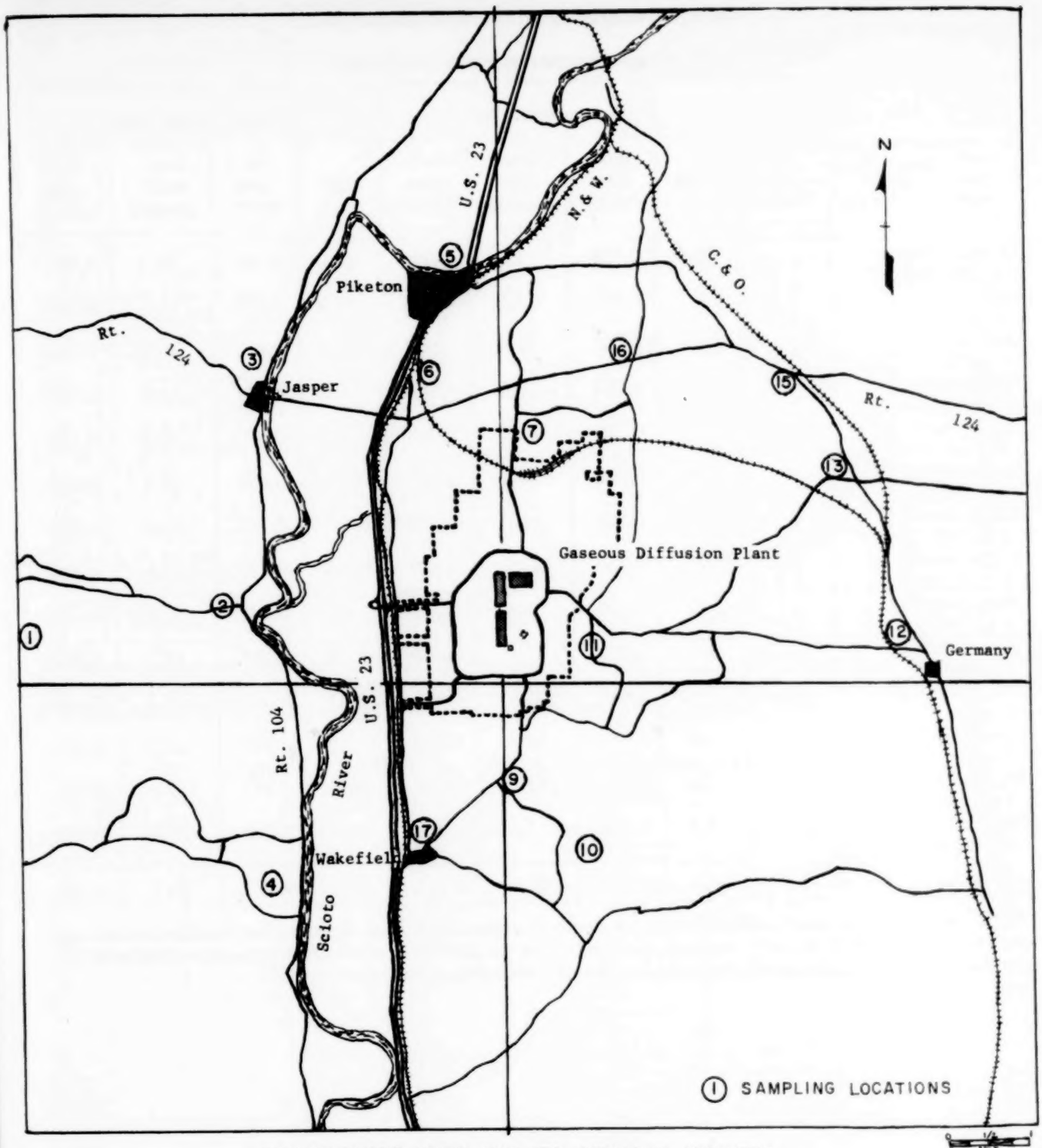
Issued July and October 1960

Environmental levels of radioactivity at the Portsmouth Gaseous Diffusion Plant for 1959 and first quarter 1960 were reported in Radiological Health Data, Volume I, Number 8. The following report presents a summary of the data for the second and third quarters of 1960.

The Atomic Energy Commission facility in Pike County, Ohio, operated by the Goodyear Atomic Corporation, is a gaseous diffusion plant The chemical processing of gaseous uranium presents the ordinary problems of the chemical industry which use toxic solvents and extracting solutions. Fumes and mists must be controlled and contaminants removed by filtering, scrubbing or other practical means to prevent atmospheric contamination.

An extensive environmental survey is conducted on a monthly basis for radioactive materials that may be released from the plant to check the effectiveness of controls which are used. The program is also designed to determine the effect, if any, on the surrounding environment. The routine program consists of sampling water, air and the general radiation background levels. Sampling locations are shown in figure 1.

The results of the environmental survey show that in no instance has the average value for any single location exceeded the maximum permissible concentrations or exposure levels for the population external to the plant boundaries.



MAP OF PLANT AREA AND ITS GENERAL VICINITY
WITH SAMPLING POINTS INDICATED
PORTSMOUTH GASEOUS DIFFUSION PLANT

FIGURE 1

TABLE 1.--GROSS STREAM WATER ACTIVITY

(Average concentrations in μμc/liter)

Stream and location from plant	Second quarter 1960				Third quarter 1960			
	Alpha	Percent MPC*	Beta and gamma	Percent MPC*	Alpha	Percent MPC*	Beta and gamma	Percent MPC*
Scioto River 4-5 mi SSW	5.9	0.030	1.8	0.009	12.2	0.061	18.2	0.091
Salt Creek 2-3 mi SSW	4.1	0.021	13.6	0.068	14.4	0.072	18.2	0.091
Salt Creek 1 mi S	4.1	0.021	1.8	0.009	6.4	0.032	40.9	0.204
Big Beaver 3-4 mi ENE	0.9	0.005	13.6	0.068	4.1	0.021	18.2	0.091
Big Beaver 2-3 mi NNW	2.3	0.012	13.6	0.068	5.0	0.025	27.3	0.136
Scioto River 4-5 mi N	13.6	0.068	13.6	0.068	14.9	0.075	36.4	0.182
Little Beaver 2 mi NW	104.5	0.523	108.0	0.540	141.0	0.705	54.6	0.273
Little Beaver 1-2 mi NNW	50.0	0.250	87.7	0.439	128.2	0.641	122.8	0.614
Plant drainage 0 mi SW	3.6	0.018	1.4	0.007	8.2	0.041	31.8	0.159
Plant drainage 0 mi W	3.2	0.016	13.6	0.068	5.4	0.027	18.2	0.091
Plant drainage 0 mi NE	8.2	0.041	122.7	0.614	85.1	0.425	168.4	0.842
Little Beaver 1 mi E	5.0	0.025	13.6	0.068	3.6	0.018	18.2	0.091
Big Beaver 2 mi NW	5.4	0.027	122.7	0.614	50.5	0.253	122.8	0.614
Scioto River 1-2 mi W	3.6	0.018	13.6	0.068	5.9	0.030	13.6	0.068
Average	15.3	0.077	38.2	0.141	34.6	0.173	50.7	0.253

*The values for the maximum permissible concentrations (MPC) for uranium and thorium in air and water are one-tenth of the MPC allowed for continuous occupational exposure as given in Handbook 69, U.S. Department of Commerce, National Bureau of Standards, issued June 5, 1959.

TABLE 2.--GROSS AIR ACTIVITY

(Average concentrations in $\mu\mu c/m^3$)

Location		Second quarter 1960				Third quarter 1960			
Number (see fig. 1)	From plant	Alpha	Percent MPC*	Beta and gamma	Percent MPC*	Alpha	Percent MPC*	Beta and gamma	Percent MPC*
1	5-6 mi W	0.03	1.5	0	0	0.10	5.0	0.95	0.1
2	2-3 mi W	.05	2.5	0	0	.03	1.5	.29	.03
3	4 mi NW	.03	1.5	0	0	.09	4.5	.13	.01
4	3-4 mi SW	.02	1.0	0.40	0.04	.08	4.0	.90	.09
5	4-5 mi N	.03	1.5	.28	.03	.05	2.5	.06	0
6	2-3 mi NNW	.05	2.5	.05	0	.06	3.0	.22	.02
7	2-3 mi N	.29	14.5	.51	.05	.19	8.5	.29	.03
9	1-2 mi S	.01	0.5	0	0	.14	7.0	1.19	.12
10	3-4 mi SSE	.05	2.5	0	0	.11	5.5	.93	.09
11	1 mi E	.03	1.5	0	0	.11	5.5	.46	.05
12	5 mi E	.02	1.0	0	0	.03	1.5	1.06	.11
13	5-6 mi NE	.02	1.0	0	0	.06	3.0	1.46	.15
15	5-6 mi NE	.03	1.5	0	0	.05	2.5	.35	.04
16	4 mi NE	0	0	0	0	.14	7.0	.96	.10
17	2-3 mi SSW	.05	2.5	0.13	.01	.17	8.5	.99	.10
	Average	0.05	2.5	0.09	0.01	0.09	4.5	0.68	0.07

*The values for the maximum permissible concentrations (MPC) for uranium and thorium in air and water are one-tenth of the MPC allowed for continuous occupational exposure as given in Handbook 69, U. S. Department of Commerce, National Bureau of Standards, issued June 5, 1959.

TABLE 3.--GROSS BETA-GAMMA BACKGROUND RADIATION LEVELS

(Millirads/hour)

Location		Second quarter 1960	Third quarter 1960
Number (see fig. 1)	From plant	Average rate	Average rate
1	5-6 mi W	0.022	0.016
2	2-3 mi W	.018	.016
3	4 mi NW	.014	.014
4	3-4 mi SW	.014	.016
5	4-5 mi N	.018	.014
6	2-3 mi NNW	.013	.015
7	2-3 mi N	.019	.016
9	1-2 mi S	.016	.014
10	3-4 mi SSE	.017	.015
11	1 mi E	.019	.016
12	5 mi E	.023	.019
13	5-6 mi NE	.013	.013
15	5-6 mi NE	.016	.016
16	4 mi NE	.015	.013
17	2-3 mi SSW	.017	.018
Average.....		.017	.015

FACTORS CONTRIBUTING TO THE OCCURRENCE OF RADIONUCLIDE LEVELS IN MARKET MILK

Division of Radiological Health
Public Health Service

A study of factors contributing to the occurrence of radionuclide levels in market milk was initiated in the St. Louis, Missouri, area by the Public Health Service in cooperation with the St. Louis County Health Department for two main reasons:

1. the demand for more knowledge in a field of high public interest, and
2. a need to determine the principal environmental and climatological factors influencing the concentration of radionuclides, especially strontium-90, in milk.

This study is intended to uncover better practical ways of reducing the levels of radioactivity in milk reaching the consumer.

The present investigation is divided into three phases. Phase I involves a comparison of the climatological, agronomic and dairy husbandry variables among the farms selected for study. This study will be correlated with similar studies in other areas including Brainerd, Minnesota, where differential levels of calcium and stable strontium have been observed. Phase II provides for intensive study of such factors as type and source of animal food, water supplies, level of stable calcium and/or stable strontium, and breed and age of cattle. It will attempt also to determine possible correlations with different radionuclides in the processed milk. Phase III will utilize the information obtained during the first two phases to determine experimentally in the field whether the radionuclide content of milk can be favorably adjusted through dairy farming practices.

The intensified study began during the spring of 1960. The first full year of the study is to be devoted primarily to Phase I with the realization that major changes in methods or points of attack may be necessary in order to fully exploit new leads developed in the course of the investigation. Analytical procedures consist of taking a sample of milk, water, each kind of feed in current use, and soil from each farm at approximately quarterly intervals. Statistical examinations of the resulting analytical data attempt to correlate levels of radionuclides found in these samples with the variables observed during the farm surveys. Analyses of the milk are presently being performed at the Robert A. Taft Sanitary Engineering Center and feeds, soil, water and rainfall samples are being analyzed in the laboratories of the St. Louis County Health Department.

A high degree of cooperation is being demonstrated between the many public and private groups for the successful collection of samples and the conduct of farm surveys. These involve the St. Louis County Health Department, the St. Louis County Radiation Advisory Committee, the St. Louis City Health Department, the Missouri Department of Health, the University of Missouri and Farmers Cooperative Associations in the metropolitan milk shed area. Within the Public Health Service the Divisions of Radiological Health and Engineering Services, including the Robert A. Taft Sanitary Engineering Center complex, are involved in planning, evaluating and developing methodology for the research project.

Between March and November 1960, samples of milk, water, feed and soil were taken at 66 farms on three separate occasions. Of these, 25 farms were selected for intensive study and observation of farming practices. All but six of these farms have been surveyed and two factors have been observed which may prove to be of considerable importance in the ecology of the radionuclides. These are:

1. thin, unproductive, rocky soil, as opposed to deep, productive, bottom land, and
2. occasional or minimal fertilization as opposed to frequent scientific fertilization.

Information pertaining to the above factors subsequently was gathered from each farm. This information and the levels of strontium-90 observed in the milk from the March and August sampling is presented in table 1.

A distribution graph of the farms, arranged in ascending order of the level of strontium-90 observed in the milk samples from the first and second sampling periods, was prepared and studied. This is shown in figure 1. It is noteworthy that very wide variations have been observed in levels of strontium-90 in milk from the farms sampled. Milk from all the farms is pooled, however, and the consumer does not receive milk from any one farm.

The gross beta radioactivity of feeds collected during the first and second sampling periods is shown in table 1. As more data become available they will be published in subsequent issues of Radiological Health Data.

TABLE 1.--STRONTIUM-90 IN MILK COMPARED WITH SOIL TYPE, FREQUENCY OF FERTILIZATION, AND PRODUCTIVITY OF THE LAND

(Radioactivity in uuc/liter)

Sampling point	Strontium-90 in milk		Soil type	Fertilization	Productivity of soil
	March	August			
1	15.9	13.6	Deep	Frequent	Good
2	15.8	14.6	Deep	Frequent	Good
3	27.4	21.2	Deep	Frequent	Good
4	29.1	24.3	Rocky, Shallow	Infrequent	Good
5	42.0	18.2	Deep	Infrequent	Good
6	10.6	8.3	Deep	Frequent	Good
7	15.9	19.4	Deep	Frequent	Good
8	12.2	18.1	No information	No information	No information
9	44.4	23.8	Rocky, Shallow	Infrequent	Poor
10	35.5	31.5	Rocky, Shallow	Infrequent	Poor
11	20.7	15.3	Deep	Frequent	Good
12	20.2	14.2	Deep	Infrequent	Good
13	21.2	12.4	Deep	Frequent	Good
14	14.0	17.5	Deep	Frequent	Good
15	21.8	13.3	Deep	Frequent	Good
16	11.0	7.3	Rocky, Shallow	Frequent	Good
17	15.3	7.3	Rocky, Shallow	Infrequent	Good
18	17.8	14.8	Rocky, Shallow	Frequent	No information
19	6.3	26.8	Rocky, Shallow	Frequent	Good
20	9.8	13.5	Deep	Frequent	Good
21	22.6	13.5	Rocky, Shallow	Frequent	Poor
22	20.1	19.0	Rocky, Shallow	Infrequent	Poor
23	39.7	16.4	Rocky, Shallow	Infrequent	Poor
24	25.8	16.6	Deep	Infrequent	Good
25	25.4	9.5	No information	No information	No information
26	13.0	13.2	Deep	Frequent	Good
27	12.8	14.3	No information	No information	No information
28	30.8	21.1	Rocky, Shallow	Frequent	Poor
29	12.0	14.8	Deep	Frequent	Good
30	22.0	16.6	Deep	Frequent	Poor
31	35.4	24.9	Rocky, Shallow	Frequent	Poor
32	35.5	20.0	Deep	Infrequent	Good
33	29.5	16.8	Rocky, Shallow	Frequent	Good
34	22.6	11.2	Deep	Infrequent	Good
35	14.9	16.6	Deep	Frequent	Good
36	19.8	15.9	Rocky, Shallow	Infrequent	Poor
37	23.9	17.0	Rocky, Shallow	Infrequent	Good
38	No information.....				
39	No information.....				
40	24.9	27.5	Deep	Infrequent	Poor
41	24.3	19.7	Rocky, Shallow	Frequent	Poor
42	17.7	13.1	Deep	Frequent	Good
43	18.3	29.4	Deep	Frequent	Good
44	37.0	27.9	Rocky, Shallow	Infrequent	No information
45	24.4	10.0	Deep	Frequent	Good

TABLE 1.--STRONTIUM-90 IN MILK COMPARED WITH SOIL TYPE, FREQUENCY OF FERTILIZATION, AND PRODUCTIVITY OF THE LAND--Con.

(Radioactivity in uuc/liter)

Sampling point	Strontium-90 in milk		Soil type	Fertilization	Productivity of soil
	March	August			
46	26.4	21.5	Deep	Frequent	Good
47	11.5	17.4	No information	Infrequent	No information
48	33.0	20.7	Rocky, Shallow	Infrequent	Poor
49	12.4	13.2	No information	No information	No information
50	7.5	19.8	Deep	Frequent	Good
51	18.7	18.0	Deep	Frequent	Good
52	22.0	14.5	Rocky, Shallow	Infrequent	Good
53	23.6	17.6	Deep	Frequent	Good
54	17.5	17.3	No information	Frequent	No information
55	11.4	17.3	Deep	Frequent	Good
56	20.7	20.3	Rocky, Shallow	Infrequent	Poor
57	16.5	9.8	Deep	Frequent	Good
58	9.0	11.6	Deep	Infrequent	Good
59	15.6	10.0	Deep	Frequent	Good
60	17.5	8.9	Rocky, Shallow	Frequent	Good
61	Dropped				
62	24.2	15.5	Rocky, Shallow	Frequent	Good
63	32.4	22.0	Rocky, Shallow	Infrequent	Poor
64	29.1	32.8	Rocky, Shallow	Frequent	Poor
65	37.9	29.0	Rocky, Shallow	Infrequent	Poor
66	12.1	20.4	Deep	Frequent	Good

TABLE 2.--GROSS BETA RADIOACTIVITY IN ANIMAL FEEDS*

(mμc/kg dry weight)

Sampling point	March 1960			August 1960		
	Ensilage	Hay	Mixed meal	Pasture	Hay	Mixed meal
1	7.8	25.1	8.9	15.2	-	15.5**
				17.1	-	3.80
2	14.7	17.1	15.1	12.9	-	14.1
3	9.0	20.0	6.0	12.0	-	10.4
4	12.7	28.0	8.0	-	-	8.1
5	13.4	45	11.1	16.0	-	12.0
6	8.7	28	10.0	24.9	-	8.4
7	-	12.3	9.8	30.4	-	9.8
8	-	23.3	11.7	12.4	-	11.4
9	-	19.7	9.1	16.6	-	12.1
10	10.1	18.7	10.8	12.1	-	8.0
11	16.0	24.5	6.4	32.2	-	8.4
12	-	14.7	14.4	19.8	-	10.5
13	4.8	10.6	12.7	10.7	-	10.2
14	-	-	11.7	13.6	-	11.0
15	14.4	-	8.0	-	-	8.5
16	14.0	-	9.7	14.0	-	9.7
17	-	112.0	10.2	21.1	-	-
18	12.9	-	12.0	-	-	-
19	-	20.0	11.0	18.0	-	9.2
20	-	32	9.3	14.9	-	9.3
21	-	27.5	11.2	17.9	-	10.8
22	-	26	13.4	-	-	13.1
23	-	26.0	6.8	24.9	-	11.4
24	-	19.3	10.7	8.1	-	8.0
				20.2		
25	12.6	-	15	8.7	-	13.9
26	18.2	14.3	10.8	19.4	-	13.7
		21.4				8.3
27	-	43.	11.8	13.0	-	8.0
				25.0		
28	-	20.3	12.4	6.0	-	10.5
29	11.4	17.0	13.8	19.4	-	13.5
30	11.4	14.7	9.1	21.4	-	11.5
31	10.6	27	7.6	19.2	-	11.3
32	-	18.0	9.0	54.1	18.2	10.1
33	-	29.0	7.6	-	24.3	-
34	7.1	43.0	9.5	-	-	9.4
35	-	23.0	10.1	-	24.0	7.3
36	-	21.0	12.0	11.4	-	7.8
37	-	19.0	6.2	-	-	9.2
38	-	14.6	4.7	-	-	-
39	5.0	-	12.0	-	-	-
40	19.3	14.0	12.5	17.4	-	10.9
41	-	36.0	12.7	29.2	-	7.8
42	13.1	10.1	11.7	26.2	-	11.8

See footnotes at end of table.

TABLE 2.--GROSS BETA RADIOACTIVITY IN ANIMAL FEEDS*--Con.

(muc/kg dry weight)

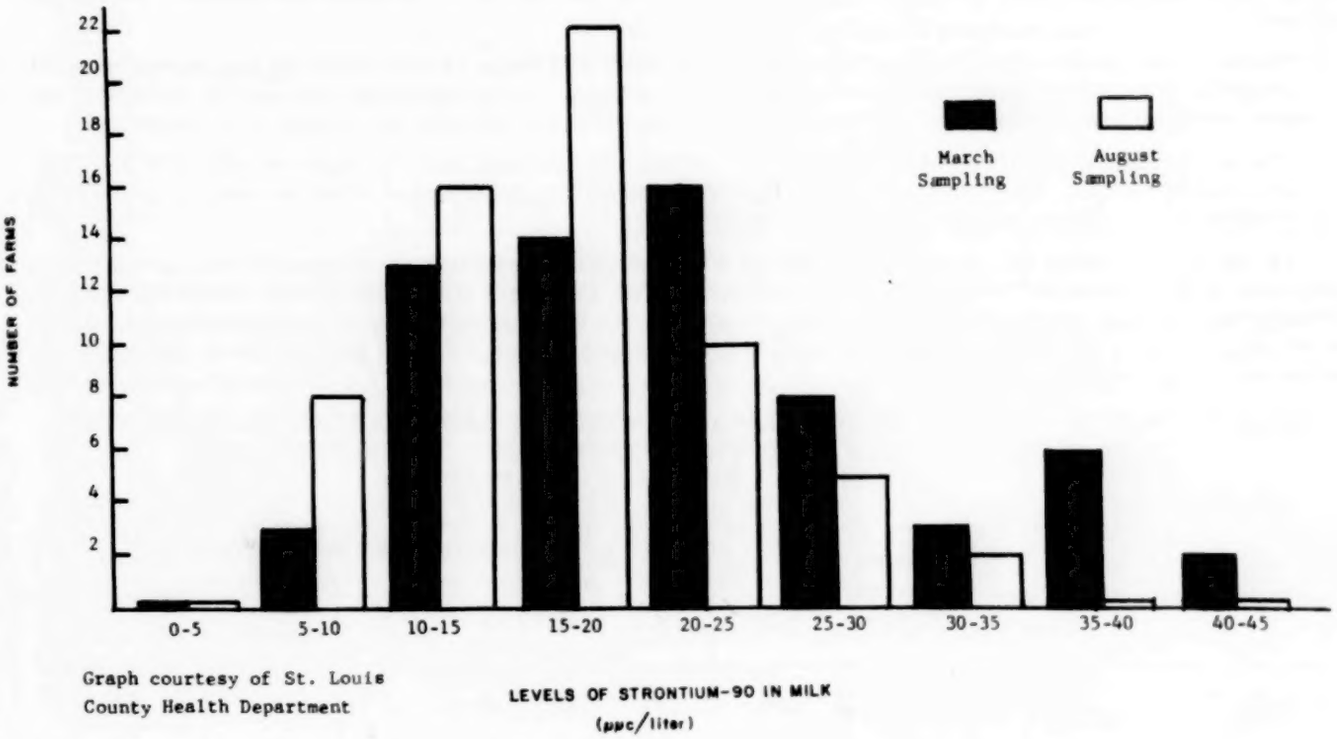
Sampling point	March 1960			August 1960		
	Ensilage	Hay	Mixed meal	Pasture	Hay	Mixed meal
43	-	50	11.3	31.6	-	13.2
44	-	21.0	8.8	13.7	-	14.3
45	8.7	22.3	11.8	31.2	-	15.8
46	9.0	23.0	-	45.4	-	8.5
47	4.5	19.0	3.5 19.6	7.5	-	9.8
48	-	46.0	10.0	26.0	-	13.6
49	11.2	12.3	11.4	10.4	-	6.7
50	10.4	14.3	8.0	25.9	-	10.9
51	11.0	15.0	9.6	19.9	-	10.8
52	10.1	36.0	11.5	-	-	10.8
53	20.4	30.0	8.8	-	24	11.7
54	29.0	-	10.9	16.6	-	12.3
55	16.0	14.9	13.7	22.1	-	12.3
56	-	21.0	12.9	16.1	-	13.9
57	8.1	23.0	7.8	11.4	-	11.0
58	30.0	8.9	7.5	18.4	-	12.2
59	-	21.0	8.3	24.1	-	-
60	-	16.6	12.2	20.7	-	14.5
61	11.9	21.0	19.5	-	-	-
62	14.2	20.1	7.8	16.7	-	11.8
63	-	34.0	8.9	20.4	-	8.4
64	9.1	18.0	11.7	20.6	-	11.9
65	-	46.0	14.0	13.7	-	13.8
66	-	-	-	18.4	-	9.6

*Up to 5% of the radioactivity may be alpha activity. No correction has been made for potassium-40 content.

**Two individual samples taken on same farm.

FIGURE I

DISTRIBUTION OF FARMS
VS.
STRONTIUM-90 CONTENTS OF MILK



Graph courtesy of St. Louis County Health Department

MICHIGAN SURVEY OF MEDICAL RADIATION EXPOSURE DURING PREGNANCY

Research Branch, Division of Radiological Health, and Actuarial Analysis and Survey Methods Section, National Office of Vital Statistics, Public Health Service

The National Office of Vital Statistics in cooperation with the Division of Radiological Health has recently completed a pilot study involving the collection of medical and dental diagnostic radiation exposure histories of women during the one year period prior to delivery of a live birth. The study was conducted from January to July 1960. The primary purpose of the pilot study was to determine optimum sampling techniques for a proposed study of this type to be conducted on a national scale. A secondary objective was the estimation of the kinds of radiation exposure to which the women had been subjected.

A systematic sample of approximately 500 cases was drawn from the birth certificates registered in the State of Michigan. Information was collected by a mail survey among the physicians and dentists who attended the mothers. The mothers were also queried, but no mention was made of radiological examinations. The primary objective of the study was fully realized. From the cooperation received from all sources, it was evident that the collection of information on radiological examinations during pregnancy for a sample of women identified from birth records was entirely feasible by mail survey. The response rate of the various sources queried was as follows:

Source	Percent responding
Physicians.....	96
Dentists.....	98
Mothers.....	87

In addition to the high rate of response, preliminary investigations, including a household quality check interview in Detroit, showed that the quality of the data collected was very high.

This study represents one approach in accumulating data for lifetime exposure of the population to radiation from medical sources. The age periods for which estimates of radiological exposure would be derived are particularly important. It is accepted that irradiation of persons prior to or during reproductive ages has a more deleterious effect on the population than irradiation of persons after the reproductive period. Furthermore, there is general agreement that exposure during the gestation period may be the most dangerous time of all, particularly insofar as irradiation of the maternal abdomen is concerned.

Some of the results of the survey pertaining to number and kinds of examinations are shown in tables 1 through 5. Percentage examination rates used below assume that respondents adequately represent the sample. A more complete analysis of the non-respondent and not ascertained groups is in progress.

Table 1 presents the effect of parity (number of previous births), and the apparent effect of age. Of the zero parity women, 51 percent had some type of radiological examination whereas only 29 percent of the first parity or higher mothers were examined.

Of the women under 25, 40 percent received a radiologic examination as compared with an examination rate of 29 percent for women over 25. However, when the effect due to parity was removed, the percentage examination rate in the different age groups did not vary significantly, i.e. 52 percent (under 25) to 49 percent (over 25) for zero parity women and 35 percent (under 25) to 27 percent (over 25) for first parity or higher women.

TABLE 1.--WOMEN DISTRIBUTED BY MEDICAL DIAGNOSTIC RADIOLOGICAL EXAMINATIONS THEY RECEIVED DURING ONE-YEAR PERIOD PRIOR TO DELIVERY OF LIVE BIRTH AND BY AGE AND PARITY

Age and parity of mother	Number sources queried	Number of radiological examinations received						
		None	1	2	3	4 or more	Nonresponse	Not ascertained
All ages	497	300	120	24	4	1	15	33
Zero parity	101	44	37	6	1	0	5	8
First parity	128	80	34	6	0	1	2	5
Second parity	99	63	18	7	2	0	3	6
Third parity or higher	169	113	31	5	1	0	5	14
Under 20 years	51	23	13	2	0	0	5	8
Zero parity	36	14	10	2	0	0	4	6
First parity	14	9	3	0	0	0	1	1
Second parity	0	0	0	0	0	0	0	0
Third parity or higher	1	0	0	0	0	0	0	1
20 to 24 years	151	84	44	9	3	1	3	7
Zero parity	43	20	17	3	1	0	1	1
First parity	59	37	15	3	0	1	1	2
Second parity	23	9	7	3	1	0	1	2
Third parity or higher	26	18	5	0	1	0	0	2
25 to 29 years	138	91	30	6	0	0	3	8
Zero parity	15	6	7	1	0	0	0	1
First parity	39	25	11	2	0	0	0	1
Second parity	37	29	4	1	0	0	1	2
Third parity or higher	47	31	8	2	0	0	2	4
30 years or over	157	102	33	7	1	0	4	10
Zero parity	7	4	3	0	0	0	0	0
First parity	16	9	5	1	0	0	0	1
Second parity	39	25	7	3	1	0	1	2
Third parity or higher	95	64	18	3	0	0	3	7

Table 2 shows the effect of race on the number of examinations. The rate among the non-white group was much greater than among whites. Of the non-white, 60 percent were examined, whereas 31 percent of the whites had examinations.

TABLE 2.—WOMEN DISTRIBUTED BY MEDICAL DIAGNOSTIC RADIOLOGICAL EXAMINATIONS THEY RECEIVED DURING ONE-YEAR PERIOD PRIOR TO DELIVERY OF LIVE BIRTH AND BY RACE OF MOTHER

Race of mother	Number sources queried	Number of radiological examinations received						
		None	1	2	3	4 or more	Nonresponse	Not ascertained
White	444	286	102	21	4	1	7	23
Non-white	53	14	18	3	0	0	8	10
Total	497	300	120	24	4	1	15	33

The effect of income is shown in table 3. Dividing the incomes at $5,000 yields a percentage examination rate of 35 percent for the lower bracket and 26 percent for the higher bracket. This is borderline significance only (7 percent), and therefore the family income effect is questionable.

TABLE 3.--WOMEN DISTRIBUTED BY MEDICAL DIAGNOSTIC RADIOLOGICAL EXAMINATIONS THEY RECEIVED DURING ONE-YEAR PERIOD PRIOR TO DELIVERY OF LIVE BIRTH AND INCOME

Family income	Number sources queried	Number of radiological examinations received						
		None	1	2	3	4 or more	Nonresponse	Not ascertained
Less than $2,500	31	16	9	1	0	0	2	3
$2,500-$4,999	128	70	38	7	0	1	4	8
$5,000-$7,499	155	108	29	8	4	0	0	6
$7,500-$9,999	59	40	11	5	0	0	0	3
$10,000 or more	22	16	4	0	0	0	0	2
Not ascertained	22	12	6	0	0	0	2	2
Nonresponse	80	38	23	3	0	0	7	9
Total	497	300	120	24	4	1	15	33

The month and the general type of examination by age and parity is presented in table 4. The rate for pelvimetries was found to be about 8 percent with a possible range of from 6 to 11 percent (a 95 percent confidence interval). Presumably, only one X-ray pelvimetry was performed before the last trimester. The rates for chest and pelvimetry X-rays were significantly higher for zero parity mothers than first or higher parity mothers (chest X-rays—33 percent vs. 19 percent; pelvimetry X-rays—16 percent vs. 6 percent).

TABLE 4.--MONTH OF EXAMINATION AND GENERAL TYPE OF EXAMINATION BY AGE AND PARITY

Type of examination by age and parity	Total	Prior to pregnancy	Month of examination during pregnancy					
			1st month	2nd month	3rd month	4th-6th months	7th-9th months	Not ascertained
Pelvimetry	37	1	0	0	0	0	34	2
Under 25:								
Zero parity	10	0	0	0	0	0	10	0
First parity or higher	8	1	0	0	0	0	6	1
Over 25:								
Zero parity	4	0	0	0	0	0	3	1
First parity or higher	15	0	0	0	0	0	15	0
Placentography	4	0	0	0	0	0	4	0
Under 25:								
Zero parity	1	0	0	0	0	0	1	0
First parity or higher	1	0	0	0	0	0	1	0
Over 25:								
Zero parity	0	0	0	0	0	0	0	0
First parity or higher	2	0	0	0	0	0	2	0
Chest X-ray	110	12	2	6	13	31	33	13
Under 25:								
Zero parity	25	6	0	1	5	3	6	4
First parity or higher	31	3	0	3	2	10	11	2
Over 25:								
Zero parity	8	1	0	0	0	2	3	2
First parity or higher	46	2	2	2	6	16	13	5
Other abdominal	18	1	2	1	1	2	9	2
Under 25:								
Zero parity	3	0	0	0	0	0	3	0
First parity or higher	6	0	0	1	1	1	2	1
Over 25:								
Zero parity	0	0	0	0	0	0	0	0
First parity or higher	9	1	2	0	0	1	4	1
Other medical	15	4	3	0	3	4	1	0
Under 25:								
Zero parity	1	1	0	0	0	0	0	0
First parity or higher	6	0	1	0	3	2	0	0
Over 25:								
Zero parity	0	0	0	0	0	0	0	0
First parity or higher	8	3	2	0	0	2	1	0
Dental	114	19	9	12	13	35	26	0
Under 25:								
Zero parity	14	2	1	0	3	4	4	0
First parity or higher	21	2	1	2	3	8	5	0
Over 25:								
Zero parity	7	2	0	0	0	5	0	0
First parity or higher	72	13	7	10	7	18	17	0
Total	298	37	16	19	30	72	107	17

Estimates of the expected number of particular diagnostic procedures by parity are presented in column two of table 5. Also, the estimated average and maximum ovarian doses per examination are presented in columns three and four. Fluoroscopic doses were excluded.

As noted above, this study represents one approach to assessing population dose due to medical sources. Estimates of ovarian dose are given below for this population group to present the methodology which could be used to adapt this type of study to the total assessment program.

TABLE 5.--EXPECTED NUMBER OF EXAMINATIONS AND APPROXIMATE ASSOCIATED OVARIAN DOSAGES TO BE RECEIVED IN ONE YEAR PERIOD PRIOR TO DELIVERY BY AN "AVERAGE" MICHIGAN MOTHER

Type of examination	Expected number of examinations in one year	Average dose in one examination[1] (mr)	Maximum dose in one examination[2] (mr)
Pelvimetries:			
Zero parity	0.16	1280	7500
Other	.06		
Placentographies:			
Zero parity	.01	1280	7500
Other	.01		
Chest X-rays:			
Zero parity	.37	0.8	3.0
Other			
Other abdominal:			
Zero parity	.03	125	200
Other	.04		
Other medical:			
Zero parity	.01	50	100
Other	.04		
Dental:			
Zero parity	.21	1.5	100
Other	.23		

[1] "Radiation Hazards II, Measurement of Gonadal Dose in Radiographic Examinations," Webster and Merrill, New England Journal of Medicine, 1957.

[2] "Bone, Skin, and Gonadal Doses in Routine Diagnostic Procedures," Laughlin et al., American Journal of Roentgenology, 1957.

From table 5 average and maximum annual doses may be computed. The results, obtained by summing the products of column two with columns three and four, are given below. The average expected number of examinations per individual was used disregarding the maximum number of examinations that an individual might have received.

Parity	Average	Maximum
Zero	220 mr	1300 mr
Higher	100 mr	560 mr

The data presented here are preliminary in two respects. The survey from which they were derived was primarily designed to study methodology. The radiological health data are a byproduct of that study. Secondly, this represents a preliminary analysis of the data. As previously stated, the non-response and the non-ascertained cases are undergoing further analysis.

NATURAL LEAD-210 CONTENT OF MAN*

Dr. John B. Hursh, Atomic Energy Project, University of Rochester, has conducted a study to determine the natural lead-210 body burden of man. At least two 10 gram aliquots from the whole body ash of each of 18 cadavers were analyzed for polonium-210. This measurement, converted to disintegrations per unit time, is equivalent to the Pb^{210} activity, since the attainment of secular radioactive equilibrium for the Pb^{210} to Bi^{210} to Po^{210} decay sequence depends on the 139 day half-life of Po^{210}, and since the material was ashed 8 years prior to the polonium measurement.

The results are reported in table 1. Since Po^{210} is in equilibrium with Pb^{210}, the data in column 3 may be interpreted as μμc of Pb^{210} per 10 grams of whole body ash. The concentration of lead-210 averages 0.015 μμc/gram of wet bone.

It is pertinent to note that the individuals whose tissues were analyzed were in the upper age brackets. Since a major contributing factor to the level of body lead is the lead in the environment, and since this has risen during the past several decades, a group of younger subjects, who were actively forming bone mineral, might yield a higher result.

TABLE 1.—NATURAL BODY BURDEN OF Pb^{210}

Age at death (years)	Total ash weight (grams)	Po^{210} net (μμc/10gm)	Total Pb^{210} in vivo (μμc)	Pb^{210} in vivo (μμc/gm of wet bone)
48	4410	0.48	302	0.023
85	1500	.32	66	.015
60	2500	.24	82	.011
57	2100	.14	40	.006
77	1700	.42	102	.020
76	2000	.25	72	.012
83	2200	.47	143	.022
77	790	.35	38	.016
36	2480	.14	47	.0063
74	2260	.47	151	.022
81	1570	.15	35	.0073
66	1970	.27	75	.013
85	2570	.46	165	.021
75	2000	.17	48	--
74	2310	.11	37	.008
33	3190	.44	188	.020
57	2500	.71	238	.032
32	1105	.38	56	.017
Average				0.015

*Summarized from a report by Dr. John B. Hursh, Atomic Energy Project, University of Rochester, published in Science, volume 132, Number 3440, 2 December 1960. The work was supported by the U. S. Atomic Energy Commission.

RADIATION INTELLIGENCE NETWORK

Division of Radiological Health
Public Health Service

Comprehensive data on radiation exposure sources, dose levels and body burdens are necessary to nearly every aspect of the radiological health program. Data from the several collection networks--air, milk and water--are presented monthly in Radiological Health Data, but are only a part of the total needed data. It is important that these existing collection activities be closely integrated and that the work be extended into presently untouched areas. This goal is being realized through the Radiation Intelligence Network presently being developed by the Division of Radiological Health, Public Health Service. The data gathered through radiological intelligence on population exposure, body burden and resultant dose to the whole body and critical organs form the foundation for assessing and minimizing the harmful effects of ionizing radiation.

As a first step in establishing a comprehensive Radiation Intelligence Network, the Division of Radiological Health is expanding its assay program of determining the amount of radioactivity in foods. The Robert A. Taft Sanitary Engineering Center has conducted some studies of individual foods as reported previously in Radiological Health Data, Volume l, Numbers 4 and 7. The present program is directed to the measurement of radioactivity in the total diet of the United States population. A further extension of the assay on the total diet is anticipated by studies on the dietary components to determine which items are indicator foods. Such foods, which presumably concentrate radioactivity, will be utilized as indices of radioactivity in foods from environmental sources of radiation.

Analyses of total diet samples from two different sources are presently underway. These are:

1. Army Composite Rations. The United States Army has composited rations from 261 items and is supplying portions of the composite to the Division of Radiological Health for radioanalyses.

2. Institutional Food Sampling Program. The Division of Radiological Health, and the Milk and Food Program of the Division of Engineering Services, Public Health Service, with the assistance of State and local health departments are establishing a sampling network of institutions for children. Eight locations throughout the United States are being selected as the first or pilot study phase. A sample will consist of the food equivalent to the three meals and snacks served to some child for seven days. One such composite sample will be collected each month at each institution.

The analyses of the samples will be conducted by the Robert A. Taft Sanitary Engineering Center and the Southwestern and Southeastern Radiological Health Laboratories. Strontium-90, total radium, and gamma scan analyses will be conducted on all samples. The results of the analyses will be reported in Radiological Health Data as they become available.

RADIATION SURVEY REPORT

State of Illinois Department of Public Health

In 1957, Illinois enacted the first State legislation requiring registration of all radiation installations in the State and authorizing investigations by the Department of Public Health for the purpose of studying and evaluating potential radiation hazards. Enactment of the Radiation Protection Act in July 1959 culminated this study. Rules and regulations are formulated and will be promulgated about March 1, 1961.

One section of the Act states that no person shall use radiation in contravention of such rules and regulations as the Department of Public Health may make to regulate exposures detrimental to health. To assure compliance with these regulations, Department personnel monitor and inspect installations of radiation producing machines and materials. Table 1 presents a progress report on 1354 machines inspected through November 15, 1960. Table 2 gives the breakdown of equipment defects according to use. In addition to the 164 industrial x-ray machines inspected, 53 radioisotope sources were surveyed in industry and 12 defects were found. It should also be mentioned that approximately 50 percent of the 164 x-ray machines are used in industrial medical departments. The balance are used for gaging and in radiographic and fluoroscopic industrial applications.

TABLE 1.--RADIATION SURVEY REPORT

Machines Surveyed as of November 15, 1960

	Non-industrial	Industrial	Total
Number of installations surveyed.....	817	144	961
Number of installations with defects...	611 (75%)	43 (30%)	654 (68%)
Number of installations without defects.....	206 (25%)	101 (70%)	307 (32%)

Since November 15, 1960 a greater number of machines have been inspected with a resulting larger number of total defects, but the relative percentages of installations with defects remain about the same.

TABLE 2.--BREAKDOWN OF TOTAL DEFECTS BY PROFESSIONAL USE

Description of defect	Industry	DDS	MD	DO	DC	DSC	DVM	HOSP	Shoe* stores	School	Gov't agency	Total	Percent defects
Inadequate filtration.....	22	201	78	5	40	9	14	33	0	1	2	405	31.1
Inadequate collimation.....	14	177	27	1	15	2	1	20	0	1	1	259	19.8
Inadequate shielding.....	10	34	22	6	12	1	1	16	0	0	1	103	7.9
Excessive exposures.....	2	1	2	0	0	0	0	0	0	0	1	6	0.5
Short timer cord.....	1	73	5	0	4	4	0	5	0	0	0	92	7.1
Reposition personnel.....	4	133	13	0	4	4	0	10	0	0	1	169	12.9
Film badge service.....	7	28	1	0	0	0	0	1	0	0	0	37	2.9
Obsolete machine (Tube Housing).....	2	28	8	1	11	0	1	5	15	3	0	74	5.6
Slow film speed.....	0	29	0	0	2	0	0	0	0	0	1	32	2.5
Therapy interlock.....	1	0	1	0	0	0	0	14	0	0	0	16	1.2
Protective clothing.....	0	1	10	1	2	0	7	7	0	0	0	28	2.2
Holding patients.....	0	1	0	0	0	0	0	2	0	0	0	3	0.2
Miscellaneous.....	18	14	17	3	11	1	5	8	0	2	0	79	6.1
Total number of defects	81	720	184	17	101	21	29	121	15	7	7	1303	100.0
Number of installations surveyed.....	144	396	145	16	89	23	32	75	29	10	2	961	
Installations with defects....	43	319	102	12	63	14	24	56	29	4	2	654	
Installations without defects	101	77	43	4	26	9	8	19	0	6	0	307	
Number of x-ray machines..	164	459	184	16	93	30	34	291	29	17	37	1354	

Notes: Abbreviations used: DDS, Doctor of Dental Surgery; MD, Doctor of Medicine; DO, Doctor of Osteopathy; DC, Doctor of Chiropractic or Chiropraxis; DSC, Doctor of Surgical Chiropody or Podiatry; DVM, Doctor of Veterinary Medicine; HOSP, Hospital.

*A total of 281 machines was discontinued as a result of the Department's initial action under the Illinois Radiation Protection Act. The figures shown here represent machines surveyed to determine compliance in questionable situations. The fourteen machines shown in the row "Installations without defects" had been removed from premises and destroyed. The fifteen machines in the row "Installations with defects" indicate the unit was still installed but its usage was questionable at the time of inspection.

61599--U.S. Dept. of Comm--DC--1961